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Three Essays on Indonesian Migration, Household Consumption, Education and Health

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Declaration

I, *Alfiah Hasanah*, declare that this thesis is submitted in partial fulfilment of the requirements for the conferral of the degree *Doctor of Philosophy*, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

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Abstract

This thesis investigates various aspects of family wellbeing using data from the only large-scale ongoing longitudinal survey in Indonesia, the Indonesia Family Life Survey (IFLS). Across three essays, I explore households' wellbeing, examining consumption, health and education in Indonesia. Analysing the impact of migration on households' outcomes, the first two essays investigate the effect of migration on consumption and health; the third essay focuses on the effect of parental health shocks on children's education.

The first essay analyses the impact of migration on food expenditure and the household food security status of migrant–sending households in the less-developed part of eastern Indonesia. This essay uses the recent IFLS East 2012 that was specifically designed to cover the seven provinces in the eastern region of Indonesia. It constructs a household food security indicator using a food consumption score (FCS) as an indicator of household food security, as suggested by the World Food Programme and the Food Agriculture Organization. The results show that migration significantly increases food expenditure and overall household expenditure. Having at least one migrant in the family increases the composite index of the FCS, as well as the family's food security. Further, the evaluation of food diversity shows that migration increases expenditure on six out of 10 food groups.

The second essay explores the impact of adult child migration on the health of elderly parents left behind. Maternal and child health is a priority of health-related policy in most low- and middle-income countries, and there is a lack of evidence on the health of ageing individuals, particularly in Indonesia. With increasing life expectancy and limited access to social security and social services for the elderly in Indonesia, the

consequences of the increasing out-migration of adult children for parental health is an important topic for investigation. This study uses IFLS data and estimates the impact of the labour out-migration of adult children on parental health. The results show that the labour out-migration of adult children has a positive and significant association with the health status of the parents left behind. The findings of this study are consistent with the view that migration increases family resources and contributes to better health care for the family left behind. The findings in the first and second essay support the well-established expectations of the new economics of labour migration.

The third essay analyses the impact that parental health shocks have on children's school enrolment and attainment. In the context of a developing country with complex disease epidemiology patterns, limited access to formal health insurance, credit markets and medical facilities, the burden of parental illness can affect children's human capital. Several parental health shocks are investigated in relation to several school outcomes for children such as enrolment and attainment. Using a child-level fixed effects model, it is evident that health shocks for both mothers and fathers significantly impact children's attendance at school; however, only fathers' health shocks significantly affect the probability that children will have to work for money. Parental health shocks are more likely to affect girls' school enrolment than boys', depending on the school level, and are more likely to result in boys joining the workforce for pay.

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Style of Thesis

The thesis is prepared in journal article compilation style format.

List of Publications Included as Part of the Thesis

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List of Abbreviations

ADL	Activities of daily living
ATT	Average Treatment of the Treated
BMI	Body mass index
BPS	Badan Pusat Statistik (Indonesian Central Bureau of Statistics)
CDC	Centers for Disease Control and Prevention
EUC	European Union Commission
FAO	Food Agriculture Organisation
FCS	Food consumption score
FE	Fixed Effect
FE-IV	Fixed Effect Instrumental Variable
FNSMS	Food and Nutrition Security Monitoring System
HDDS	Household dietary diversity score
HFS	Household food security
HH	Household
IFAD	International Fund for Agricultural Development
IFLS	Indonesia Family Life Survey
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IV	Instrumental variable
LATE	Local average treatment effect
MSH	Migrant–sending households
NELM	New economics of labour migration
NN	Nearest-neighbour
OLS	Ordinary least squares
PIHPS	Pusat Informasi Harga Pangan Strategis
PSM	Propensity score matching
SRH	Self-rated health
STM	Short-term migrants
WFP	World Food Programme
WHO	World Health Organization

Chapter 1: General Introduction

Indonesia is a developing country in the midst of a series of transitions, ranging from demographic and epidemiological to social, economic and political. While social indicators have gradually improved and rates of poverty have declined steadily in rural and urban areas, there are around 26.58 million poor people in 2017. Seven out of 10 Indonesians are in the productive age; however, around 19.4 per cent of youth aged 15–24 are unemployed (IMF 2017). The 2015 intercensal population survey reported that approximately two million Indonesians had moved to towns and cities, mainly from rural areas for work reasons (BPS 2015). Migration, especially rural to urban, is an important feature of economic growth in developing countries.

Strong efforts in poverty alleviation resulted in a reduction of the percentage of people living in poverty from 17.75 per cent in 2006 to 10.7 per cent in 2016; however, around 22 million people are still in absolute poverty. Indonesia's strong economic growth places this country into a middle-income status; however, limited government investment in the health system has resulted in insufficient facilities and workforce numbers in the health care service. This country faces maternal and child health problems as well as complex disease epidemiology patterns coupled with limited access to formal health insurance, credit markets and medical facilities (WHO 2017).

Migration is a family strategy that brings many positive and negative consequences to the livelihood of migrants at their new destinations and the migrant–sending households (MSHs) back at home. The positive impact of migration for MSH relates to the increase in family income; it eases credit constraints and reduces risk and volatility. Remittance promotes productive investment in physical and human capital in MSHs. The

negative impact of migration relates to the potential losses of income and family disruption associated with migrants' absences.

This thesis consists of three essays: the first two essays analyse the impact of migration on households' outcomes, ranging from consumption to health in Indonesia; the third essay examines health and children's education. The first essay focuses on the impact of migration on household food consumption and the food security of the MSH. The second essay examines the impact of adult children's migration on the health of the parents left behind. Household education is analysed in the third essay by looking at the impact of parental health shocks on children's education.

The first two essays focus on migration as a household strategy. While the first essay analyses the effect of migration on food consumption and food security for the MSH, the second essay focuses on the impact of adult children's migration on the health of parents left behind. There are several important reasons to investigate the effects of migration on people's livelihood in Indonesia. Migration has become a household strategy to escape the vulnerability of poverty. Given the excess domestic supply of labour and low labour productivity, it is a 'labour exporting' strategy (Vargas-Silva, Jha, & Sugiyarto 2009). In terms of international migration, around 9 million Indonesians are working overseas in 2017 and account for 7 percent of this country's total labor force and remit around US$8.9 billion remittance in 2016 (The World Bank 2017). Migration to cities—also known as 'rural–urban' migration—is a relatively unconstrained process in Indonesia. An increasing number of people live in urban areas. Migration from rural areas to larger cities has contributed to an increase in urban population growth in the last 20–30 years (Meng & Manning 2010). The Indonesia Family Life Survey (IFLS) 2000–2007 indicated that around 60 per cent of migrant workers come from rural households. During the Asian financial crisis 1997-1999, lost jobs and layoffs prompted large numbers of people to

return to their villages of origin; however, many subsequently returned to urban areas due to lack of employment in rural regions (Breman and Wiradi 2002).

With increasing life expectancy and longevity, the number of people aged over 60 is projected to increase; however, most low- and middle-income countries place a high priority on maternal and child health and combating infectious diseases in their health-related policy. Observing Indonesia's health profile, the second and third essays focus on the health of household members. The second essay relates migration as a household decision to health outcomes by investigating the impact of migration on the health of the parents left behind. The third essay examines parental health shocks in relation to a range of school outcomes for children. All three essays are based on data from the IFLS.

The IFLS is the only ongoing longitudinal survey in Indonesia that collects extensive information on socio-economic, demographic and economic characteristics at an individual, household and community level. Information about health measures and access to health care facilities is contained in its health module. The first wave of the IFLS was conducted in 1993 and covered 83 per cent of the Indonesian population living in 13 of the nation's 26 provinces. Around 16,204 households and 50,148 individuals were interviewed in its recent survey in early 2015 (Strauss, Witoelar, and Sikoki 2016). IFLS data makes the analysis of the dynamics of behaviour possible at individual, household and community levels.

The first essay in this thesis, Chapter 3: Labour Migration, Food Expenditure and Household Food Security in Eastern Indonesia (a revised version of which has been published as 'Labour Migration, Food Expenditure, and Household Food Security in Eastern Indonesia' in *Economic Record*), comprehensively investigates the impact of migration on food expenditure and the household food security status of MSHs using data from less-developed parts of eastern Indonesia. In eastern Indonesia, 79 out of 100

districts are categorised as most vulnerable to food insecurity. This study exploits the availability of the recent IFLS East 2012 dataset, since it covers seven provinces that were not included in the previous IFLS. This essay constructs a household food security indicator using a food consumption score (FCS) as an indicator of household food security as suggested by the World Food Programme (WFP) and the Food Agriculture Organisation (FAO).

Previous literature has taken into account the potential endogeneity that is the possibility that migration can be correlated with unobservable individual and family characteristics that also affect the outcomes of interest. MSHs or remittance-receiving households may have unobserved characteristics that are different from those of their counterparts. The propensity score matching (PSM) method is used to control for possible selection on the basis of observable characteristics by comparing households with very similar observable traits but a different migration status.

The main finding in first essay is that migration increases food expenditure and the total expenditure of MSHs. Migration increases food security status as measured by the FCS and results in an increase in food diversity for at least six out of 10 food groups. In addition, migration also leads to an unhealthy diet by increasing expenditure on snacks, sugar, beverages and dried food.

The second essay, Chapter 4: Adult Child Migration and Elderly Parent Health: Recent Evidence from Indonesian Panel Data, investigates the impact of adult children's migration on the health of the parents left behind. Increasing life expectancy and longevity have been reported not only in high-income countries but also in low- and middle-income countries; however, most developing countries focus on combating

infectious diseases and maternal and child health as priorities in health policy. Therefore, there is limited research on the health of ageing populations in developing countries.

The second essay contributes to literature in several ways. It estimates several indicators of health measures: self-rated health status, number of unhealthy days, visits to outpatient care, episodes of acute morbidity and whether medication is prescribed. The essay also covers a longer period of panel data using four waves of the IFLS, starting from IFLS 1997 and including the recent wave of IFLS 2014. The transmission channel of the impact of migration on parental health is estimated. Possible gender differential outcomes between son and daughter migrants, the health of parents aged over 50 and the effect of parents living in rural area are also investigated. The fixed effects (FE) method is used to address potential endogeneity, and instrumental variables are applied in the sensitivity analysis.

The results of the second essay show that the out-migration of adult children has a positive and significant association with the health status of the parents left behind. The findings of this study are consistent with the view that migration increases family resources and contributes to better health care for the family left behind. Estimation on the potential transmission channel shows that households with migrant children have a significantly higher per capita expenditure. Migration contributes to an increase in household income that leads to an increase in expenditure, the purchase of preventive care, such as medical and nutritional input, and contributes to better access to health care, resulting in a better health status of the parents left behind.

Investment in children's human capital is reflected in improvements to future economic and social wellbeing. Occupation, education and other characteristics of children are highly correlated with their parents. While social scientists focus on the impact of parental presence on a child's educational outcomes, economists focus on the

effect of family disruptions, such as divorce or parental death, on children's education, as well as income shocks that may accompany this change.

The third essay investigates the impact of parental health shocks on children school outcomes. Parental illness results in consequences that differ from other sources of family disruptions. In addition to increasing medical expenditure, parental illnesses restrict further the time constraints of other healthy family members, and as there is often no time limit on the duration of an illness, other family members may find it difficult to adjust. Limited access to formal health insurance, credit markets, and medical facilities in developing economies also worsen the household burden of parental illness over time.

The third essay, Chapter 5: Parental Health Shocks and the School Outcomes of Children: Evidence from Indonesian Panel Data, contributes to literature in several ways. It uses a longitudinal dataset containing four waves of data taken from 1997–2014 from the IFLS. Applying child-level FE, it explores several types of health shock measurements and estimates the possible impact of parental health shocks on several educational outcomes, including school enrolment and school attainment. Unlike previous studies, it explores school enrolment, such as hours in school, school attendance and the possibility of working for pay. Parental illness may reduce the amount of parental time allocated for supervising children's studies, which may affect school attainment such as test scores and grade repetition. Using a child-level FE model, two age groups (children and adolescents) and the possibility of gender differences in children's outcomes are studied.

The results illustrate that parental health shocks have a negative impact on children's school outcomes. Estimation on individual parent health shocks show that both mothers' and fathers' health shocks significantly affect the hours of school and grade

repetition of children aged 6–14 years; however, only maternal health shocks affect cognitive assessment. For children aged 15–24 years, both mothers' and fathers' health shocks negatively affect children's school attendance; however, whereas health shocks to fathers are likely to result in children working for money, health shocks to mothers are more likely to affect grade repetition.

Gender differential estimations, particularly on school enrolment, show that parental health shocks are more likely to affect girls than boys. Parental health shocks are more likely to result in boys working for pay. Girls aged 6–14 are likely to spend less time in school due to parental health shocks. Girls aged 15–24 are also less likely to be in school if their fathers experience health shocks; however, they do not take up work. Boys are more likely to work if their father experiences health shocks,

This thesis is organised as follows. Chapter 2 discusses the theoretical framework relating to the empirical work of each essay. Chapters 3, 4 and 5 consist of the three research essays discussed in this General Introduction. Each chapter contains sections describing existing academic literature, the country setting, data and sample, empirical method, empirical results and the conclusions reached. Chapter 6 summarises the relevant conclusions and policy recommendations.

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Chapter 2: Theoretical Framework

The objective of this chapter is to introduce the theoretical framework that relates to the empirical work of each essay in my thesis.

2.1 New Economics of Labour Migration

The new economics of labour migration (NELM) was initiated by Stark and Bloom in 1985. The development of NELM represented a paradigm shift in migration literature, as it identified migration as a livelihood approach and provided an optimistic view on migration. The NELM framework of migration lies between neoclassical and macro-structural approaches. NELM highlights the role of a collective family strategy in the decision to migrate and the outcome of migration (Stark & Bloom 1985; Stark 1991). This theory relates to the interdependence between migrants and their families. Some factors that determine migration decisions are shared so that households maximise joint incomes and minimise risks. Not only the human capital of migrants but also the social capital, such as social networks, contributes to the outcome of the migration. Migration is defined as a product of household actions and it links migrants with non-migrants in a set of relationships.

The NELM theory stands out from classical theories in several ways. NELM realistically includes many factors that determine the decision to migrate. It explicitly relates the decision to migrate with the outcome of migration, using remittances as a connecting variable (Taylor & Fletcher 2001). Migration decision-making in NELM is at the household level; households are considered both to have more ability and be more able to manage the costs and risks of migration compared to individuals. Migration will take place as long as an imperfect market exists in the country of origin, such as the capital

market and credit insurance market. Beyond increasing absolute income, the decision to migrate is also driven by relative income differentials (i.e., comparing wages with neighbours) (Stark & Taylor 1989; Stark 1991).

Three hypotheses of migration motivations are highlighted by NELM: 1) the relative deprivation hypothesis, 2) the insurance hypothesis and 3) the investment hypothesis. A relatively deprived household is more likely to use migration as its household strategy (Stark & Taylor 1989) to better their economic position in their community or country. Households use migration to insure themselves against difficult times, such as failing markets and financial risks, unemployment, food insecurity and failing crops (for further examples, see Lucas & Stark 1985). Remittances link migrants with the households they left behind. The investment hypothesis argues that remittance stimulates development in migrant-sending regions, as it is invested in income-generating activities such as agriculture and business.

There are at least three aspects of NELM that are not present in the neoclassical theory of migration. The relative deprivation hypothesis states that individuals migrate not only because of differences in 'absolute income' but also due to of 'relative deprivation' (Stark 1991; Stark & Taylor 1991). The attitude towards risk is that migration from rural to urban can be viewed as a diminution of risk in the long-term. Urban activity is considered to be risky in the short-term; however, in time, it can be viewed as more stable than rural activity, which depends on climate (Stark & Levhari 1982; Stark 1991). The role of social capital is the factor that fosters and shapes migration in the destination community. The existence of a community stems from its origin or location; all migrants in destination areas are linked with one another and with those in their areas of origin, which means they can attract more people to move for better conditions (Massey et al. 1987; Zabin et al. 1993; Massey 1999).

NELM has been criticised for focusing heavily on the supply rather than the demand of labour migration; however, empirical evidence shows the positive effect of migration on migrant-sending countries, specifically less-developed and developing countries. International migration has become an integral part of the development strategy of many developing countries. It helps to address two problems of developing countries: high supply of labour and low foreign exchange income (ADB 2012). As a country with a high population, labour exporting helps to reduce domestic unemployment and increase labour productivity in Indonesia.

Migration can reduce the poverty trap in a utility maximisation model of consumption by increasing the wage (w) and possible higher return of asset (r) in the budget side. The increase in return also represents reducing the NELM credit distortion.

Ramsey (1928) introduces a growth model in which saving rates are determined endogenously. Saving and consumption are variables that are determined according to householders optimising intertemporal utility. Individual utility maximisation in which householders select consumption to maximise utility, *U* is shown in terms of net present value with $\rho > 0$ as the discount rate and the household/family size growing by the rate *n*:

$$U = \int_0^{\infty} u\left[c\left(t\right)\right] e^{nt} \cdot e^{-\rho t}\, dt \quad \text{..... (2.1)}$$

Households accept the real wage rate, *w*, and real return, *r*, on homogenous per capita assets, *a*, giving the household budget constraint:

$$\dot{a} = w + ra - c - na \quad \text{..... (2.2)}$$

The time path of per capita consumption that maximises household utility is determined by solving the Hamiltonian in present value terms:

$$J = u(c)e^{-(\rho-n)t} + \lambda\left[w + (r-n)a - c\right] \qquad (2.3)$$

Using the first-order conditions, the Euler equation and transversality condition give:

$$\dot{c}/c = \phi(r - \rho) \qquad (2.4)$$

Where $\phi = u'/-u''c$ is the inverse of the elasticity of marginal utility, u', with respect to *c*. When multiplied by the growth in consumption, $\dot{c}/c$, it gives the compensation households require at the margin in terms of the rate of return, *r,* exceeding the discount rate, ρ. The higher the return to asset accumulation, *r* (i.e., saving), and the more that households will forego in current consumption for future consumption increases $\dot{c}/c$. However, poor households are forced to 'over-consume' to survive, resulting in less savings and, therefore, less future consumption. This lowering of $\dot{c}/c$ is the poverty trap.

However, as viewed in NELM, migration can be seen as a household strategy, the outcome of which not only increases income but also overcomes an imperfect market in the origin country.

Migration can reduce the poverty trap by increasing income, $w + ra$, in the budget constraint with higher wages, *w*, for the migrant and possibly higher return to assets, *r* (this represents reducing the NELM credit distortions). Another benefit of migration is to increase the productivity of the migrant through improved working conditions and human capital (education and health). Since $r = f'(\hat{k}) - \delta$ then $\dot{c}/c = \phi\left(f'(\hat{k}) - \delta - \rho\right)$ shows this can also increase consumption growth.

2.2 Human Capital Outcomes of Migration

The loss of a young and talented workforce (brain drain) is one of the consequences of migration that could negatively impact development in migrant-sending countries. However, migration also opens many channels that contribute to development in developing countries, such as through remittance transfers, international trade and foreign direct investment (De Haas & Plug 2006; Gamlen 2006).

The NELM framework contributes to studies on human capital formation as an outcome of migration. Studies in this area investigate two side effects of migration: monetary and non-monetary channels. Studies on the monetary side of migration explore the income effect of remittance. The non-monetary channel investigates the effect of parental or other family members' out-migration on outcomes such as education, health and labour of children and other members of the family. These studies explore outcomes of migration relating mainly to three human capital indicators: health (Yang 2004; Deb & Seck 2009; Lu 2010, 2012; Riosmena et al. 2012; Kroeger & Anderson 2014; Chang et al. 2016); education (Edwards & Ureta 2003; Acosta 2006; Cabegin 2006; de Brauw & Giles 2006; McKenzie & Rapoport 2006; Nguyen & Purnamasari 2011; Antman 2012); and labour supply of MSHs (Rodriguez & Tiongson 2001; Giorguli 2006; Chen 2006; Guarcello et al. 2010; Acosta 2011; Antman 2011; Accetturo & Infante 2013).

Literature on migration considers both the absence of migrants and remittance transfer when investigating the effect of migration on human capital formation in MSHs. The effect of remittance is to shift budget constraints, so that the family can afford an ideal education for the children left behind. Being additional income, remittance stimulates educational investment for the remaining household members (Edwards & Ureta 2003; Yang & Choi 2007; Calero et al. 2009). However, it takes time before MSHs

receive remittance; therefore, the children left behind have to choose between schools and contributing to the household's income, as out-migration means loss of labour in the family. The absence of parents or adult children in the family due to out-migration can have negative results; for example, lack of supervision and parental time can negatively affect children's school outcomes (McKenzie 2005; Robles, Oropesa & Salvador 2011). Migrants might look at education differently if there is a relatively low return on schooling in destination countries, and will substitute schooling of their children for migration (Mora & Taylor 2006).

The effect of migration on health relates to the income effect of remittance. Households receiving remittance increase their expenditure on health care services, from routine primary care to hospitalisations. Primary care and hospitalisation expenditure are higher among remittance-receiving households (Amuedo-Dorantes et al. 2007). The positive effect of migration on human capital formation of MSHs creates potential intergenerational benefits; for example, migration induces resource flows, allowing children of MSHs to have better nutrition and health care protection (Mansuri 2006). Studies on this topic show contradictory conclusions. A positive effect on children's weight and vaccinations was found in Guatemala, as reported by Acosta Pablo and Humberto (2007). An increase in hospital births, birth weight, survival and breastfeeding in Mexico was reported by McKenzie (2005); infant mortality dropped among households receiving remittance (Kanaiaupuni & Donato 1999); and positive health behaviour effects on infant health were reported by Frank (2005) and Frank and Hummer (2002). However, the absence of a parent had a negative effect on the utilisation of preventive health care for children (Hildebrandt & McKenzie 2005). Migration can be a source of stress and MSHs lose social support due to the absence of the migrant. The adults left behind, such as parents and partners, are more susceptible to stress, which adversely affects their health

status (Lu 2012). Consequences of migration to both migrants and their immediate families are stress and anxiety, which affect both physical and mental health status (Macdonald, Macintyre & Ellaway 2003; Carballo 2007; Deb & Seck 2009).

2.3 Human Capital Investment of Children

The first theoretical framework for investment in children's human capital was devised by Becker and Tomes (1979); it is known as the intergenerational transmission of human capital model.

Becker and Tomes (1979) postulated an intergenerational altruism of children's human capital in their model of intergeneration transmission of human capital. Their model has provided a theoretical foundation for much research relating to intergenerational estimations over the last two decades. Several assumptions are highlighted in their model: 1) parents are not liquidity constrained and can borrow against their children's future earnings, since capital markets are perfect; 2) the only motivation for schooling is its contribution to future income; 3) neither investment of parental time nor the process of bereavement affects the value of schooling; 4) parental death does not affect the opportunity cost of children's time; and 5) parents treat children equally so that future productivity is the reason to invest in children's education. This framework results in the notion of equality between the marginal returns and marginal costs of education to determine household optimal investment.

Parents can borrow against the future earnings of their children and investments in children are unaffected by shocks to a family's current income, such as loss of a parent; however, the capital market is imperfect. In their follow-up paper, Becker and Tomes (1986) highlighted that households cannot borrow against children's future earnings because of imperfect capital markets. Households with liquidity constraints reduce their

investment on children's education; however, households with sufficient assets and precautionary savings remain unaffected. Becker and Tomes' (1986) theoretical framework is used to explain the effects of parental health shocks and other income shocks on investment in children's human capital.

Most households in developed countries are able to smooth their consumption and investment; however, households in developing countries are likely to have liquidity constraints due to the absence of well-developed credit and insurance markets (Jensen 2000) and are unable to insure against shocks, such as income shocks, due to parental health shocks. Shocks such as parental illness affect household income and, in turn, affect children's school enrolments. Due to the imperfect capital market in developing countries, the effect of parental health shocks that produce income shocks on investment in children's education are potentially large. Moreover, parental health shocks can effect the quality and quantity of investment in children's education through multiple channels.

Serious health conditions have strong effects on household wealth (Wu 2003); poor health and major illness lead to large declines in household net worth (Kochar 1995; Smith 1999; Wagstaff 2007). Significant out-of-pocket health care expenses reduces a household's net worth, which can have serious consequences in poor households (Kurshid & Ajay 2014). Reduction in work time and/or labour participation is the next pathway or channel of adverse health effects that results in a decline in household income (Fenn & Vlachonikolis 1986; Wolfe & Hill 1995). Such a decline due to health shocks is followed by a reduction in non-consumption expenditure and, therefore, a reduction in household investment in children's education.

Health shocks to adults at a productive age can be very detrimental to other family members, particularly as most of them are parents raising children. In addition to

declining household expenditure on education, parental health shocks affect investment in children's human capital. A decline in the amount of time devoted to education is one of many implications. Parents with chronic illnesses are not only less likely to contribute to their children's education, but also care giving in general. Parental illness may affect family patterns; often, children and adolescents must become involved in helping at home, such as taking on extra domestic chores and responsibilities for sibling care as well as caring for unwell parents (Grabiak et al. 2007). Children whose parents are ill may shift their time not only to domestic chores but also to market production activities such that working replaces schooling. Edmonds and Pacvnik (2005) highlighted the effect of child labour on the human capital formation of children; they found that, even when working and schooling went hand in hand, the negative effects of working could manifest through a reduction in the amount of time available for studying, playing and sleeping.

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Chapter 3: Migration, Food Expenditure and Household Food Security in Eastern Indonesia

3.1 Introduction

Migration relates to economic development in both migrant-receiving and migrant-sending countries. It involves a great number of people, increases labour supply in receiving countries and results in high remittance inflow to sending countries. A large body of literature reports the socio-economic impact of migration on both sending and receiving countries. Migrants significantly contribute to low-cost sectors in host countries such as elderly care, food processing and domestic work. Meanwhile, remittance is one of the factors that links the positive effect of migration to the socio-economic development of the sending country. Migration confers many benefits to the livelihood of those who migrate, both at their destination and with regard to the family they leave behind. For MSHs, remittances increases family income, eases credit constraints and promote productive investment in both physical and human capital.

One of the welfare objectives of development programs is poverty reduction. There are multiple aspects that constitute poverty. Monetary poverty, food insecurity, and poor nutrition and material wellbeing imply poverty; however, they are conceptually different and do not always coincide (Adams 1991). Under the NELM framework, the outcome of migration is shared between migrants and MSHs (Stark & Bloom 1985). This framework has resulted in numerous studies on how migration can help MSHs escape from poverty (Stark & Taylor 1989; Adams 1991; Adams & Page 2005; Spatafora 2005). However, there are very few studies that link the poverty effect of migration to the issue of food insecurity.

This essay seeks to expand on the few studies that have focused on Indonesian migration in several ways. First, it extends the effect that migration has on poverty in relation to food security' using the FCS as an indicator of household food security as suggested by the WFP and FAO. The FCS is a proxy indicator of current household food security and it represents several elements of food access and food utilisation (consumption). Second, this study utilises the less-developed part of eastern Indonesia as its setting. This region has been targeted by the government of Indonesia for promoting poverty alleviation and more balanced development. As reported in the *Food Security and Vulnerability Atlas of Indonesia* (Food Security Council & WFP 2010), in this region, 79 out of 100 districts are categorised as most vulnerable to food insecurity. As such, it would normally be expected that migration would be a household strategy to smoothing consumption and improving a household's living standards.

A lack of data has been the main reason for little research being done on the poorer eastern provinces of Indonesia. Information on eastern Indonesia is not available from any of Indonesia's other major data sources such as Indonesia Basic Health Research (RISKESDAS), the National Socio-Economic Household Survey (SUSENAS), The National Labor Force Survey (SAKERNAS),Village Potential Statistics (PODES) and the Demographic and Health Survey (DHS). The availability of the IFLS East 2012 dataset makes investigation into this region possible. IFLS East 2012 is the first household survey on the eastern part of Indonesia and comprises seven provinces. These seven provinces (East Kalimantan, Southeast Sulawesi, East Nusa Tenggara, Maluku, North Maluku, Papua and West Papua) were never included in the previous IFLS (Satriawan et al. 2014). Utilising this data represents this study's third contribution to the literature on Indonesian migration.

This paper analyses the effect of migration on food expenditure, investigating the outcome of migration on three household expenditure measures: the logarithms of monthly food expenditure, monthly per capita food expenditure and total monthly expenditure. To understand the effect on household food security, the investigation is differentiated between three FCS groups. Further investigation on food diversity is applied by investigating the outcome of migration on the expenditure of large sets of food groups.

3.2 Overview of Existing Literature

3.2.1 Effects of Migration

Neoclassical theories view migration as an individual decision in which the cost and benefits of the movement are considered. However, starting in the 1980s, many extensions to those theories developed. Indeed, NELM (Stark & Bloom 1985) has shaped the framework of many investigations on the outcome of migration on migrant-sending countries. The NELM framework (Stark & Bloom 1985) postulates that the decision to migrate is made at the household level. It is a household strategy to maximise expected income and minimise risks, as a response to various kinds of market failures. The framework of NELM has resulted in extensive literature being written on the direct effect of remittances on the economy of migrant-sending countries. Remittances are a means to escape from poverty (Adams 1991, 2006; Weber et al. 2007; Gupta, Pattillo & Smita 2009; Beegle et al. 2011; Park & Wang 2010), smoothing consumption (Stark & Levhari 1982; Lucas & Stark 1985; Stark & Bloom 1985; Stark & Rosenzweig 1989; Amuedo-Dorantes & Pozo 2011), and providing working capital and liquidity (Giuliano & Ruiz-Arranz 2005; de Brauw & Rozelle 2008).

To investigate the development effect of migration, studies have explored the expenditure pattern of MSHs. A substantial body of research on this topic reports that MSHs use remittances to finance consumption, investment in human capital (such as education and health) and physical investment (such as housing). Remittances are spent not only on daily consumption needs but also on the construction of better house (Oberai & Singh 1980), durable goods, health care and housing (Airola 2007). Economic transfers of remittances support consumption as well as investment; the standard of living increases in the short-term and development of rural areas is supported in the long-term (Lall, Selod & Shalizi 2006). In rural areas, remittance not only increases consumption but also boosts expenditure in agricultural and non-agricultural areas (Hamilton, DeWalt & Barkin 2003). Numerous studies highlight the multiplier effect of remittances to receiving economies, even though it is used for consumption (Durand et al. 1996; Taylor et al. 1996; Sumata, 2002; De Haas, 2010). Remittances create a multiplier effect when they are spent on domestically produced goods (Ratha 2007), thereby playing an important role in the development of migrant-sending economies.

Within studies that look at the expenditure patterns of MSHs, there are few that focus on the effect of migration on food consumption expenditure and even fewer that examine the effect of migration and food expenditure on nutrition, health or food security. Studies that address the relationship between migration and food security have been conducted by Nguyen and Winters (2011) on Vietnam, and Karamba, Quiñones and Winters (2011) on Ghana. Using two measures to proxy food security (i.e., per capita food expenditure and per capita calorie consumption), Nguyen and Winters show that short-term migration significantly contributes to food consumption and food security in Vietnam. Karamba, Quiñones and Winters (2011) use food consumption patterns as

measures to investigate the relation between migration and food security in Ghana. They show that food expenditure increases only in high migration regions.

3.2.2 Migration Measures

Studies about the impact of migration can be divided into two approaches. Some studies argue that the impact of migration is channelled through remittances; therefore, they measure the impact of remittances on the expenditure pattern of MSHs. Other studies believe that remittance might inadequately capture the impact of migration. Migration can have an impact beyond the income effect of remittances, such as through knowledge, information or changes in MSH labour (Taylor & Mora 2006; Zezza et al. 2011). In terms of expenditure outcome, the remittance effect is not distinct from the migration effect (Taylor & Mora 2006). Notable studies in two United States (US) migrant-sending countries, Mexico and Ecuador, use different measures of migration, yet they report similar findings. A broader set of household consumption and investment in Mexico was investigated by Taylor and Mora (2006) using migration measures rather than a remittance approach. Applying migration history as an instrument for international migration decisions, Taylor and Mora found that budget shares on investments, health and consumer durables are relatively large compared to food and housing. A recent study by Göbel (2013) used a remittances approach and investigated household expenditure patterns using the 2005/2006 Ecuador Living Standard Survey. Using parametric and non-parametric methods and instrumental variable (IV) methods, Göbel found that remittances significantly increased expenditure on education health and housing, but decreased expenditure on food. This essay uses a migration approach to portray the complex impact of migration. It uses migration status rather than remittances, and differentiates between migrants and non-migrants in the empirical model.

Several studies have considered not only movements made internally or internationally, and from rural to urban areas, but also the length of migration period as important factors affecting the outcome of migration. Chandrasekhar, Das & Sharma (2015) focused on short-term migrants (STM) and investigated the impact of migration on food consumption expenditure in India. In Vietnam, Nguyen and Winters (2011) differentiated between STM and long-term migrants in their empirical model. Both studies used the IV approach; however, opposing impacts on food consumption were reported. STM increased per capita food expenditures in Vietnam; however, MSHs with STM had a lower per capita food consumption compared to non-migrant households in India. Long-term migrants from Vietnam had weaker ties and fewer remittance transfers to origin compared to STMs because they tended to stay permanently at their destination once they were established. Further, STMs from rural India worked in informal and unorganised sectors without written job contracts.

3.2.3 FCS

In 1996, the World Food Summit clarified a globally accepted definition of food security:

> Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Food and Agriculture Organization of the United Nations 1996, p. 5).

Four pillars of food security were added at the 2009 World Food Summit on food security: food availability, food access, food utilisation and food stability.

At the national level, a food secure country is one that has adequate food availability that comes from production, stocks and imports to meet all the citizens' food requirements for a healthy life. At the household level, household food security (HFS) is when a household is able to keep sufficient nutritional intake for physical wellbeing by ensuring

three sets of entitlements: food availability, food accessibility and food utility (Maxwell & Frankenberger 1992).

Two agencies of the United Nations, the WFP and FAO, actively focus on fighting hunger, malnutrition and food insecurity. In 2012, a joint statement by the WFP and FAO (2012) suggested two indicators of food security: HDDS (household dietary diversity score) and FCS (food consumption score). FCS is a composite score capturing the frequency of weighted diet diversity using a standard weight for each food group to reflect nutrient density, elements of food frequency, dietary diversity and the relative nutritional importance of food consumed by households. FCS it is an acceptable proxy indicator of current HFS (World Food Programme Vulnerability Analysis and Mapping 2008).

3.2.4 Self-Selection of Migration

Previous literature has taken into account the possibility that individuals who migrate are a selected group. Migration can be correlated with unobservable individual and family characteristics that also affect the outcomes of interest. As researchers are unable to control for these factors, an estimation of the impact of migration will be biased (McKenzie & Yang 2010). In this case, selection might lead to an overestimation of the positive impact of migration on food expenditure.

Methodological problems in studying the outcome of migration can be addressed by using a randomised experiment (if one is available). A migrant lottery system for migration from Tonga to New Zealand is very similar to a randomised experiment. Using this lottery system, Stillman, Gibson and McKenzie (2012) were able to randomly compare migrants with non-migrants; however, this method is very rare and this study was the only one found in the literature that utilised this approach. An exogenous shock from nature, such as exchange rate shocks before and after the Asian financial crisis in

2007, as in Yang (2008), provide a good natural experiment; however, this type of shock does not provide a useful model for other studies to follow.

In the absence of experimental data, various econometric approaches exist to deal with non-random selection of migration. In the presence of at least two points of time data, FE and difference methods are able to control for time-constant unobserved heterogeneity. In the presence of time-varying unobserved characteristics, the IV method is mostly used. The challenge in using the IV method is to find the valid instrument, since weak instruments result in biased estimators (Baum, Schaffer & Stillman 2003).

Another method to address the selection issue is PSM (Rubin 1974; Rosenbaum & Rubin 1983). This method is able to control for a possible selection bias in investigating migration outcomes, particularly observable variable bias. Conditional independence assumption (Lechner, 1999) is the important identifying assumption of the PSM method. It depends on the availability of a large and informative set of pre-treatment independent variables with which MSH can be matched with fully equivalent non-MSH. Under this assumption, the assignment of households to the treatment (migration) is based entirely on a set of observed pre-migration attributes. If there is a set of exogenous variables (X) such that, conditional on X, household outcomes are independent of the treatment assignment, the different outcomes between MSHs and a set of matched non-MSHs with identical pre-migration attributes can be estimated (McKenzie, Gibson & Stillman 2010; Poppe 2010). Comparing several estimation strategies, McKenzie, Gibson and Stillman (2010) also report that the PSM method uses a good set of exogenous pre-migration variables, demonstrates a better estimation than ordinary least squares (OLS) and outperforms IV regressions with relatively weak instruments.

The PSM approach has been used in a number studies on migration and the outcomes of migration. These include the effects of remittances on household labour supply (Acosta 2006); the impact of migration and remittances on wealth accumulation and distribution (Garip 2014); the effect of past migration to the US on the wealth of older Mexicans (Wong et al. 2007); internal migration and household wellbeing in Albania (Hagen-Zanker & Azzari 2010); remittances and household expenditure patterns in Tajikistan (Clement 2011); the impact of children's migration on elderly kin's health (Kuhn, Everett & Silvey 2011); the impact of temporary and permanent migration on household expenditure in Moldova (Poppe 2010); and the impact of migration on several household expenditures and assets in Bangladesh (Sharma & Zaman 2009).

3.3 Data

3.3.1 Food Security

Before the redefinition of food security at the international forum of the World Food Summit (WFS 1996), food security was variously defined and interpreted. Many measures and indicators of food security were used in research and policy. Various indicators were also used among the studies that investigated the link between migration and food security. The frequency of difficulties in meeting food needs was used by Fransen and Mazzucato (2014) as an indicator of food security in Burundi. Anaglo et al. (2014) measured food security using food availability in Ghana. Their study showed an opposing outcome of migration. Remittances improved living conditions as shown by the increase in the food security index of the households in the lowest group of the asset index in Burundi; however, in Ghana, there was no significant differences in the food availability of migrant-sending communities. Using a simple indicator of food security, the two studies contributed to a preliminary investigation of the link between migration

and food security; however, food security requires more than just frequency of meeting food needs or the availability of food (WFP 2009).

Two studies applied various combinations of HFS indicators. Crush (2013) used three types of food security indicators: the household food insecurity scale, household food insecurity access prevalence, and household dietary diversity scale (HDDS). Tageje (2014) used five indicators to measure food security: land ownership, types of crops grown and their purposes, post-harvest food management, amount of food produced and the time after harvest, and food availability and access in the market. Crush's study looked into migrants in urban areas of destination by comparing food security between migrants and non-migrants in Southern Africa. Tageje focused on the hypothesis that peasant migrants contribute to agricultural production in the rural areas of their destinations in Tanzania. Tageje (2014) showed that migration improved food security in the rural area of destination; however, migrants in urban areas were more likely to be food insecure compared to non-migrant households, as reported by Crush (2013). Both studies used many types of independent data collection; however, they did not investigate causality in their analyses. Applying different empirical analyses may contribute to establishing causality and furthering the policy implications of these studies.

3.3.2 East Indonesia Context

There are several reasons why it is important to investigate the impact of migration on people's lives in Indonesia. Indonesia has a long history of rural–urban migration. Migration to cities is a relatively unconstrained process and has contributed to a 25 per cent increase in urban population growth in the last 20–30 years (Meng & Manning 2010). Approximately 60 per cent of migrant workers come from rural households (Nguyen & Purnamasari 2011). National Statistics Agency of Indonesia defines lifetime migrant if

province of birth is different from regency/municipality of present residence while recent migrant if province of residence 5 years ago is different from province of present residence. Population censuses from 1970 to 2010 show that the net number of inter-province migrations have increased for both recent migrants and lifetime migrants (Figure 3.1). During the Asian financial crisis, lost jobs and layoffs meant that many people returned to their villages of origin (Wiradi 1998; Sandee 1999); however, lack of employment in rural regions pushed these return migrants back to urban areas (Ananta 2000; Hugo 2000).

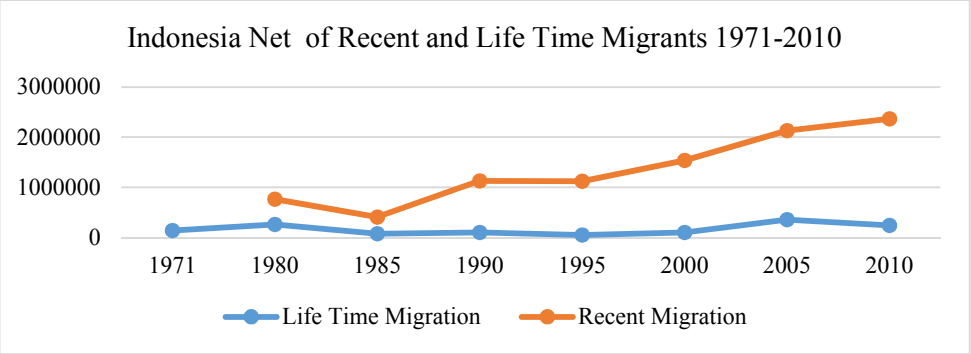

Figure 3.1: Net Numbers of Recent and Lifetime Migrants in Indonesia, 1971–2010

Source: Population censuses 1970, 1980, 1990, 2000 and 2010, and intercensal population survey 1985, 1995 and 2005 (CBS).

There are around 68 million Indonesians vulnerable to poverty. With incomes only slightly higher than those below the official poverty line, these people are likely to fall into poverty in times of negative shocks. Crises, inflation, job losses, illnesses and disasters are likely to cause them to fall below the poverty line; thus, these people are likely to migrate. The International Fund for Agricultural Development (IFAD) highlights factors that contribute to migration such as unemployment and poverty in rural areas caused by reduced access to land and other productive resources (IFAD 2014).

The reduction of poverty in Indonesia is slowing. Between the years 2005 and 2013 absolute and relative poverty in Indonesia are decreasing at a slower rate. Relative poverty

fell from 16 percent of the total population (or 35 million people) to 11.5 percent (or 29 million people) (Figure 3.2). Although the poverty rate in 2014 has fallen from 24 per cent (in 1999) to 11.3 per cent (in 2014), inequality has increased. In 2013, the Gini coefficient showed the highest index ever recorded in the history of Indonesia. Inequality has increased over the last five years from 2008 to 2012 (Figure 3.3). The proportion of the highest 20 per cent of income of the people increased from 41.2 per cent in 2009 to 48.6 per cent in 2012. Conversely, the proportion of income of the poorest 40 per cent decreased from 21.2 per cent in 2009 to 16.9 per cent in 2012 (Figure 3.4). Increasing inequality makes it difficult for people to get onto a pathway out of poverty.

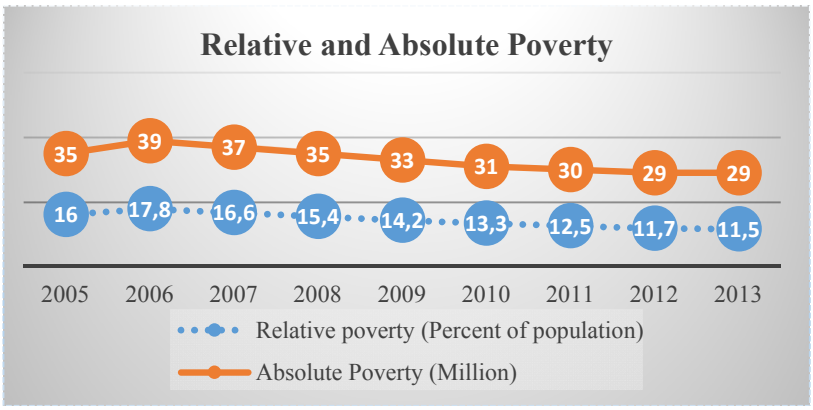

Figure 3.2: Relative and Absolute Poverty, 2005–2013

Source: Badan Pusat Statistik (2013).

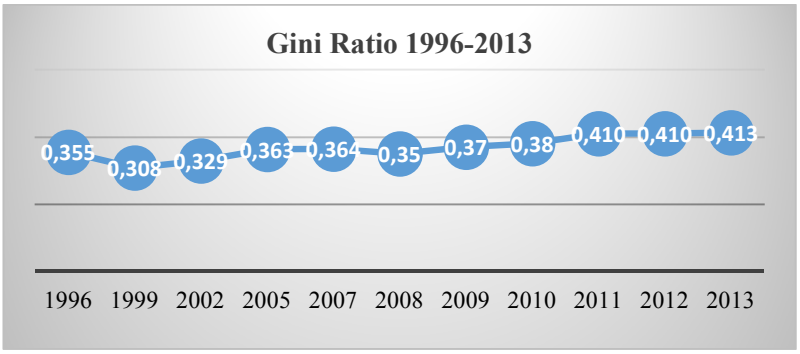

Figure 3.3: Gini Ratio, 1996-2013

Source: Badan Pusat Statistik (2013).

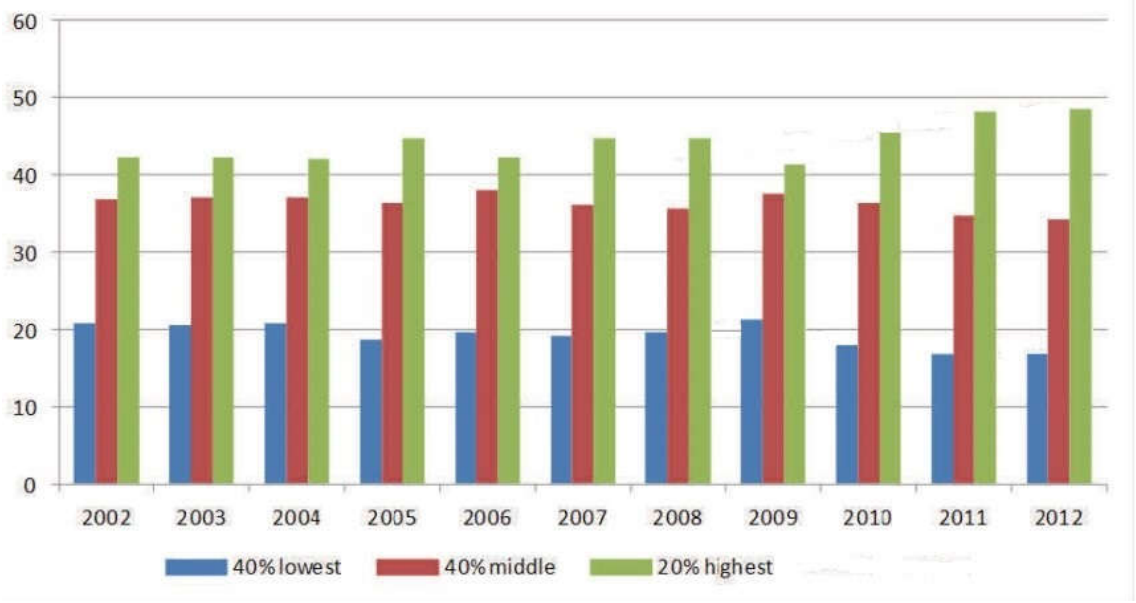

Figure 3.4: Income Distribution from Three Households Groups, 2002–2012

Source: Badan Pusat Statistik (2013).

Relative disparities between urban and rural, as well as between eastern and western regions, are important features of Indonesia's development process. The eastern provinces of Indonesia are characterised as less-developed compared to the western regions. Lower per capita rates of gross domestic regional production, higher labour participation rates and higher household size compared to the national average are some of the characteristics of the eastern part of Indonesia. Two provinces in this region are poorer and four provinces have a minimum wage below the national average (Table 3.1). Moreover, 79 per cent of districts in the eastern region are classed as most vulnerable to food insecurity (Badan Pusat Statistik 2013). Provinces in the eastern part of Indonesia are not only poor but grow slowly compared to the national average (Booth 2004; Hill et al. 2008). The *Global Food Security Index 2012* reported that it is not food unavailability but the lack of affordability and vulnerability to food price shocks that contribute to food insecurity in Indonesia (Economist, 2012). Reducing poverty, regional disparity and food insecurity are the challenges facing Indonesian development.

Table 3.1: Statistics of seven provinces of Eastern Indonesia, 2012

Provinces in Eastern Indonesia	Average Household size (2010)	Labour Force Participation Rate (2010)	Minimum Monthly Wage (thousands) 2012	Poverty Rate (2012)	Gross Regional Domestic Product per Capita (thousands) 2012
Nusa Tenggara Timur	4.6	74.77	925	20.41	6,532.9
Kalimantan Timur	4.1	69.89	1,177	6.38	105,849.2
Sulawesi Tenggara	4.4	73.10	1,032.3	13.06	14,067.7
Maluku	4.8	66.98	975	20.76	6,088.3
Maluku Utara	4.8	67.82	960.5	8.06	5,697.4
Papua Barat	4.5	72.27	1,450	27.04	45,842.7
Papua	4.3	79.27	1,585	30.66	25,530.9
All Indonesia provinces)	3.9	69.66	1,121.46	11.66	30,812.9

Source: BPS (2012)

3.3.3 Data Construction and Descriptive Statistics

This study uses data from the IFLS East 2012, a large-scale multi-topic household and community survey that is specifically designed to cover the seven provinces in the eastern region of Indonesia. These seven provinces (Nusa Tenggara Timur, Kalimantan Timur, Sulawesi Tenggara, Maluku, Maluku Utara, Papua Barat and Papua) were not included in earlier IFLSs.

IFLS East 2012 provides numerous opportunities for researchers to gain insight into household and individual outcomes and wellbeing in the eastern part of Indonesia, and to promote more balanced development in Indonesia. IFLS East 2012 surveyed approximately 10,000 individuals in around 2,500 households living in 99 communities (Sikoki et al. 2013). It originally selected 3,159 households, which jointly had 10,887 household members, and 98.8 per cent of them provided at least a partial interview. It

collected a broad range of information on consumption related to households and individuals, asset incomes and work; individual health and health care utilisation; and living arrangements and subjective wellbeing.

Although the IFLS East 2012 survey was not designed to focus on migration, the adult module of the IFLS collected a broad range of information about all household members aged 15 years and over regarding their educational, marital, work, retirement, pension and migration histories in the long-term (six months or more). Besides information on basic household characteristics, the IFLS includes a broad array of data on household consumption habits. The consumption module recorded information on the value of foods purchased and consumed in the last week and purchases of household and personal care items during the last month. Both quantities and purchase prices for several frequently purchased staples were also collected.

At community level, IFLS includes community characteristics. The variable of 'Infrastructure of road and phone in the last 5 years' is surveyed in module of Community & Facility of the IFLS 2012. The survey asked whether there are any important events that relate to development of infrastructure of road and phone that occur since 5 years ago, such as ; new road opening, construction of new road, introduction of telephone (land line), first time mobile phone can be used in the village or opening of the first internet shop.

Migration in the IFLS is defined as movement across a village to live in a new location for over six months. A migrant is defined as a person at least 15 years or older who moves across village boundaries to live in the new location for over six months and for work-related reasons. A household is categorised as migrant-sending if it has at least one migrant.

Based on above criteria, 407 people were identified as migrants from 10,887 individuals. From 2,547 households surveyed by IFLS EAST in 2012, 331 households were categorised as MSHs. Three provinces that had a high number of migrants are East Kalimantan, North Maluku and Papua. People in the eastern part of Indonesia mostly migrate within Indonesia, with a balanced proportion moving to another village or town and big city. Initial migration mostly occurred after 2007. The profile of migrant individuals (presented in Table 3.2) shows that most migrants are male, most are the husband or head of household, and most had high school as their highest level of education.

Table 3.3 presents the summary statistics of the estimation sample of both MSHs and non-MSHs. It describes the characteristics of the head of household, households, and communities. MSHs can be found in either a rural or urban area and mostly consist of four family members that have one child aged between 6 to 18 years old. The mean age of a household head is 41 years and 86 per cent of them are male. The MSHs have at least four family member that finish primary school. Over 50 per cent of MSHs have their own house, own a non-farm family business and some have land for farming.

Table 3.2: Individual Profile of Migrant and Non-Migrant

Individual profiles	**Migrant (%)**	**Non-Migrant (%)**
Province of origin:		
East Nusa Tenggara	2.9	97.1
East Kalimantan	5.3	94.7
South Sulawesi	3.2	96.8
Maluku	3.5	96.5
North Maluku	4.4	95.6
West Papua	3.3	96.7
Papua	3.9	96.1
Gender:		
Male	59.2	48.8
Female	40.8	51.2
Status in household:		
Husband/head	37.4	22.9
Wife	16.0	18.2
Son/Daughter	25.1	46.7
Sibling/brother/sister in law	4.91	1.66
Nephew/Niece/cousin	9.09	1.57
Grandchild	1.97	5.61
others	5.53	3.36
Highest education:		
Primary school	15.2	62.8
High school	53.8	30.3
University	30.47	6.0
Marital status:		
Single	40.3	52.0
Married	57.5	42.3
Divorce/Widow	2.2	5.7
N:	407	10480

Table 3.3: Means and Standard Deviation of Estimated Sample

	MSHs		Non-MSHs	
	Mean	**SD**	**Mean**	**SD**
Head of household (HH) characteristics:				
Age	41.91	12.99	44.75	13.22
Sex	0.86	0.35	0.83	0.37
Marital status	2.01	0.36	2.10	0.37
Self-employed	0.65	0.47	0.28	0.45
HH characteristics:				
HH size	4.42	2.32	4.25	2.04
Number of children aged under 5	0.67	0.83	0.67	0.81
Number of children 6–18 years	1.08	1.30	1.27	1.28
Number of members to finish primary school	3.72	2.03	3.34	1.80
Own house	0.54	0.49	0.79	0.40
Number of rooms in house	5.20	2.4	4.93	2.13
Use electricity	0.94	0.24	0.81	0.39
Own land	0.34	0.47	0.58	0.49
Own non-farm family business	0.50	0.50	0.39	0.49
Community characteristics:				
Infrastructure of road and phone in the last five years	0.27	0.44	0.18	0.38
N:	331		2216	

3.3.4 Constructing FCS as Current HFS

The WFP and FAO suggest that both FCS and HDDS should be used to measure food security. While FCS is used for classifying households that are food insecure, the HDDS is used for monitoring the quality of diets. The HDDS provides a useful snapshot of the situation, and FCS provides a more complete picture of consumption that may be more appropriate for in-depth food security assessments. HDDS and FCS are not interchangeable; the choice between the two indicators depends on the time and resources available for data collection. HDDS assesses the 24-hour recall of the consumption of 16 food groups, which can be expensive and time consuming in the survey. FCS is

appropriate for in-depth food security assessments as it combines a longer reference period and the incorporation of the frequency of consumption. FCS is a composite score of food consumption at the household level of eight weighted food groups using a seven-day recall. FCS is a composite score representing the frequency of weighted diet diversity using a standard weight for eight food groups. The eight food groups are cereals and tubers, pulses, vegetables, fruit, meat and fish, milk, sugar and oil. A higher FCS indicates improved HFS. Table 3.13 in the Appendix to this essay provides an example calculation of FCS as directed by WFP's *Emergency Food Security Assessment Handbook* and the Indonesia Food and Nutrition Security Monitoring System-FNSMS (WFP 2009)

The completeness of the information available in the food consumption and eating frequency modules in IFLS East 2012 makes it possible to calculate FCS as a proxy for the current food security indicator at the household level. The food frequency module provides information about eating frequency (number of days in a week) of several types of food in the last week. Further, the consumption module provides information on the monetary value of several food types consumed in the last week. Information on food frequency contains only five groups of food. I combined the two modules to obtain information on the number of days in a week for a total of eight food groups. To measure the volume and weight (i.e., kilogram or litre) of the food bought in the last week, the monetary value of food expenditure in the consumption module was divided by the price of food, with reference to the National Strategic Food Price Information Center (Pusat Informasi Harga Pangan Strategis / PIHPS).To obtain the number of days of consumption of food, the weight was divided by national average daily consumption based on the report of the National Socio-Economic Household Survey (SUSENAS), Statistics Bureau of Indonesia. FCS is a continuous variable and so standard statistics such as mean and

variance can be calculated. Summary statistics of the FCS calculated in this study are presented in Table 3.4.

The calculated FCS are categorised into three food consumption groups based on the thresholds for Indonesia: FCS-acceptable if the FCS is over 42, which means adequate food consumption; FCS-borderline if the FCS is between 28.5 and 42; and FCS-poor if the composite score is less than 28. Table 3.14 (see Appendix) shows the corresponding thresholds of FCS groups suggested by the FNSMS.

Table 3.4: Summary FCS Statistics

	MSHs		Non-MSHs	
	Mean	**SD**	**Mean**	**SD**
FCS	56.36	18.66	48.18	19.62
FCS-acceptable	63.72	14.46	61.57	13.98
FCS-borderline	37.42	3.99	35.40	3.95
FCS-poor	21.85	4.05	21.01	5.21
N	331		2216	

3.4 Estimation Methods

In estimating the impact of migration, this study begins by estimating the basic equation:

$$Y_i = \beta_0 + \beta_1 M_i + \beta_2 X_i + \varepsilon_i \quad \text{..... (3.1)}$$

Where: Y is a variable outcome of interest of the i_{th} household; M_i is a dummy that indicates a migrant household if 1 and 0 for otherwise; X_i is the vector of control (exogenous) variables; β_1 and β_2 are parameters to be estimated; and ε is the error term. The vector of exogenous covariates includes variables that capture head of household characteristics, household characteristics and community characteristics.

Three sets of outcome variables are to be estimated. First, three measures of expenditure: the logarithms of monthly food expenditure, monthly per capita food expenditure and monthly total expenditure. All expenditure measures recorded in IFLS East 2012 are in the nominal monetary value of Indonesia Rupiah in 2012. The second set of outcomes to be estimated are the current household statuses for food security based on the threshold group: FCS-acceptable, FCS-borderline and FCS-poor. The third set of outcomes—monthly expenditure on eight food groups—reveals the impact of migration on household food diversity.

To identify the presence of migrants in households, I define migration as having occurred when at least one member of the family moved across village boundaries for six months or more for work-related reasons. In this definition, MSHs are households in which at least one member is a migrant who moves across village boundaries for more than six months.

3.4.1 Propensity Score Matching

This paper takes into account possible selection bias, as discussed in Section 3.2.4. Household characteristics may be the main factor behind migration and may also be responsible for positive outcomes of migration (e.g., higher food consumption expenditure or better status of food security). In this situation, comparing the outcome of migration between MSH and non-MSH may be misleading.

The PSM method (Rubin 1974; Rosenbaum & Rubin 1983) allows us to control for possible selection bias in investigating migration outcomes, particularly observable variable bias. In this method, non-random selection is corrected by comparing each MSH with a similar non-migrants household (non-MSHs) based on their propensity scores. The probability of being in the treatment group is calculated as the propensity score (having a

migrant in the household) conditional on observed baseline characteristics. A series of observed characteristics are used to estimate the propensity score to predict the probability that a household will engage in treatment (migration) (Rubin 1974; Rosenbaum & Rubin 1983). The outcome of the non-MSHs (control group) is interpreted as the counterfactual outcome of the MSHs (treatment group) in the absence of migration (treatment).

The bias that results from the observed variations is reduced when the estimation uses the PSM method. Black and Smith (2004), and Ichino, Mealli and Nannicini (2008), highlighted the advantages of the PSM method over the OLS method. First, PSM provides an explicit method with which a common support can be ensured. PSM ensures MSHs can be compared with comparable non-MSHs with a sufficient overlap between the distributions of the observed characteristics of the two groups (Heckman, Lochner & Taber 1998). Second, the non-parametric nature of PSM means it does not depend on restrictive functional form assumptions for identification.

To match the treatment (MSHs) and control (non-MSHs) groups, PSM develops an index of propensity score. Dehejia and Wahba (2002), McKenzie, Gibson and Stillman (2010), and White (2006) have suggested that PSM gives more accurate non-experimental estimates when households self-select into the program. As Jalan and Ravallion (2001) highlighted, the mean impacts can be estimated without arbitrary assumptions about functional forms and error distributions when using the counterfactual approach.

When using the PSM method, households are divided into two categories: $D_i = 1$, if they have at least one member of family migrates and $D_i = 0$ if not. Further, Y_{i1} = outcome having a migrant in the household and Y_{i0} = outcome having no migrant in the household. ΔY_i = the effect of treatment for household i is the difference between the

outcome of having a member of the family migrate and the outcome without having a member of the family migrate, as specified below:

$$\Delta Y_i = E(Y_{i1} / D_i = 1) - E(Y_{i0} / D_i = 1) \quad \text{(3.2)}$$

Observing households in two different states simultaneously is not possible. The outcome of having a family member migrate can be observed, but this cannot be observed in the absence of migration (counterfactual). PSM provides a solution using a conditional independence assumption, which states that there is a set *X* of covariates observable such that, after controlling for these covariates, the potential outcomes are independent of the treatment status. The treatment assignment is 'as good as random' after controlling for *X* (Lechner 1999). PSM assumes that there exists a set of observable conditioning variables (X) for which the non-migration outcome (Y_{10}) is independent of migration status (M) or $Y_{i0} \perp M \mid X$.

$$E(Y_{i0} / D_i = 1, X_i) = E(Y_{i0} / D_i = 0, X_i) \quad \text{(3.3)}$$

In PSM, migration participation is conditioned on the propensity score $P(X)$. The propensity score is the probability of households having a migrant conditional on a vector of observable characteristics, such that $P(X_i) = \Pr\{D_i = 1 / X_i\}$. The average treatment effect of household *i* is:

$$\Delta Y_i = E\left[Y_{i1} / D_i = 1, P(X_i)\right] - E\left[Y_{i1} / D_i = 0, P(X_i)\right] \quad \text{(3.4)}$$

A probit regression will be used to estimate the predicted probabilities of having a migrant D_i, or having no migrant based on a series of observable covariates X_i.

$$\Pr\{D_i = 1 \mid X_i\} = \Phi(h(\beta_i X_i + e)) \quad \text{(3.5)}$$

The STATA *psmatch2* provided by Leuven and Sianesi (2003) will run the estimation. It is a program to estimate the propensity score and to test the balancing property.

3.4.2 Matching Algorithms

Three types of matching algorithms are applied to obtain robust estimates of counterfactual approaches. The closest propensity is the criteria in nearest-neighbour (NN) matching, which chooses a counterfactual household for each MSH based on closest propensity. A matching partner for a household in the treatment group (MSH) is chosen if a household in the comparison group (non-MSH) has the nearest propensity score. Two kinds of NNs are used: 'with replacement', in which an untreated unit is used more than once as a match, and 'without replacement'. If the closest neighbour is not a good match, caliper matching is used, since the NN matching will result in a poor match. Applying caliper matching means that individuals from the comparison group are chosen as matching partners for individuals from the treatment group that lies within the caliper (propensity range) and is closest in terms of the propensity score. The last algorithm is kernel matching, which matches each unit in the treatment group (MSH) to a weighted sum of comparison units (non-MSHs) with the greatest weight assigned to units with the closest scores (Heckman, Lochner & Taber 1998). According to Austin (2009), most studies of this kind use small numbers such as 0.005 or 0.001. Following Raynor (1983), a tighter caliper is more appropriate and produces close matches for efficiency. This study sets 0.001 as its caliper matching algorithm.

3.4.3 Propensity Score Estimation

The choice of covariates should be based on economic theory and sound knowledge of previous research. Heckman, Ichimura and Todd (1997) and Bryson Dorsett and Purdon (2002) underlined that over-parameterised models should be avoided because,

while the inclusion of non-significant variables may not bias the estimates, they can increase variance. Covariates based on the characteristics of the heads of households, households and the community are used to estimate the propensity score.

The probit model in Table 3.5 presents the propensity scores of being MSHs or having at least one migrant in a household given the observed pre-remittance characteristics. The dependent variable is equal to '1' if a household has at least one migrant, and is '0' otherwise. The estimates show that, in terms of the characteristics of the heads of households, the probability of having a migrant decreases significantly with the age of the head of household. The older the head of household, the lower the probability of migrating to find new or better jobs. Further, members of households have less mobility for migration when they have to leave behind an ageing parent. The probability of having a migrant varies with type of work. The probability of having a migrant increases with type of work. Member of households from non self-employed head of households have a higher probability of migrating to find new or better jobs compared to those come from self-employed households. Members of households from self-employed head of household are more likely to remain at home.

In terms of household characteristics, the probability of having a migrant decreases significantly with household size. This is in line with a study in Vietnam reported by Tran et al. (2012). This negative relationship indicates that migration is less likely to occur in a larger households, which are mostly found in lower- and middle-income groups. The probability of having a migrant in a household increases significantly if the household has no house or land. Education plays an important role in the decision to migrate. Households with members who finish at least primary school are more likely to migrate. Provinces in eastern part of Indonesia have the lowest electrification ratio and Papua has the lowest electrification ratio of all, where about one out of three households has

electricity. Higher availability of electricity facilitates expanded economic activities for community and individual. It support greater educational opportunities and attainment and therefore it increase the probability of migration.The probit estimation show that having electricity contributes to the probability of migration. Having a non-farm family business decreases the probability that a household member will migrate. This works in similar way as the head of household's type of job; having a secure job at home decreases the probability of migration.

The main community characteristic that positively affects the decision to migrate include is development. The probability of migration increases significantly if there has been development in road and telecommunications infrastructure within the last five years. A community that has a developed infrastructure, such as road and telecommunications, increases access to migration and forms a migration network.

Table 3.5: Probit Model Predicting MSHs

Variable	Coefficient	t-test (prob)
Head of household (HH) characteristics:		
Age	-0.0169	(0.00)**
Sex	0.263	(0.173)
Marital status (single, married, divorced)	-0.119	(0.163)
Type of work (1 = worker, 0 = self-employed)	0.492	(0.108)***
HH characteristics:		
HH size	-0.363	(0.150)*
Number of children under 5 years	0.139	(0.159)
Number of children between 6 to 18 years	-0.078	(0.084)
Number of members finished primary school	0.339	(0.139)*
Own house (1 = yes, 0 = no)	-0.639	(0.110)***
Number of rooms in house	-0.028	(0.026)
Use electricity (1 = yes, 0 = no)	0.676	(0.244)**
Own land (1 = yes, 0 = no)	-0.259	(0.114)*
Own non-farm family business (1 = yes, 0 = no)	0.227	(0.105)*
Community characteristics:		
Infrastructure of road and phone in the last 5 years	0.244	(0.115) *
Constant	-0.848	(0.458)
N	2117	
Pseudo-R^2 McFadden	0.244	
Pseudo-R^2 Nagelkerke	0.291	
Per cent correct	93.25 %	
LR test (prob)	254.358	
	(0.000)***	

Standard error in parentheses.
*p < 0.05. ** p < 0.01. *** p < 0.001.

3.5 Results and Discussion

Tables 3.5–3.7 present the estimated results of the impact of migration on food expenditure, current food security status and food diversity using both PSM and OLS estimations. Figure 3.5 shows a histogram of the propensity scores and Figure 3.6 shows a kernel density estimate of propensity scores for treatment and control groups. An overlap in the propensity scores of the treatment and control groups are shown in the two graphs.

Table 3.6 presents the impact of household member migration on three outcomes of expenditure of MSHs: the logarithms of monthly food expenditure, monthly per capita food expenditure and monthly total expenditure. The estimation result using OLS and PSM show that migration positively contributes to the three types of household expenditure. Both approaches produce a positive and significant impact with a level of at least 10 per cent.

The difference of the average treatment effect on the treated (ATT) group in relation to food expenditure and total expenditure is robust in three different matching techniques. The three matching algorithms—NN using caliper 0.001 with replacement, NN using caliper 0.001 without replacement and kernel matching—show that both the value of the coefficients and its significance are similar. The counterfactual approach in all three matching algorithms shows that MSHs significantly increase monthly expenditure on food from 18 to 28 per cent, increase monthly per capita expenditure on food from 20 to 31 per cent and increase monthly per capita total expenditure from 23 to 27 per cent. The similar magnitude of the outcome and significance is also produced in OLS estimates. The estimation shows not only that migration has a positive impact on food expenditure, but also on the total expenditure of households. These positive impacts support earlier findings of studies that focus on the impact of migration on food consumption and food expenditure such as Nguyen and Winters (2011), and Karamba, Quiñones and Winters (2011). These findings support earlier findings that migration and remittance help by smoothing consumption, increasing food expenditure (Rosenzweig & Stark 1989) and investing in daily needs (Kabki, Mazzucato & Appiah 2004; Mazzucato 2009).

Table 3.6: Impact of Migration on Food Expenditure (PSM and OLS)

Outcome Variables	PSM Estimates (Average Treatment of the Treated (ATT))						OLS Estimates		
	Matching Algorithm	Diff	SE	t-test	N_T	N_C	B	SE	N
Monthly expenditure on food (log)	NN Caliper = 0.001 with replacement	0.239 *	0.126	1.90	104	1959	0.176 *	0.075	2101
	NN Caliper = 0.001 without replacement	0.282 **	0.120	2.34	102	1959			
	Kernel	0.182 **	0.871	2.09	53	1959			
Monthly per capita expenditure on food (log)	NN Caliper = 0.001 with replacement	0.244 *	0.133	1.84	104	1959	0.230 **	0.079	2101
	NN Caliper = 0.001 without replacement	0.315 **	0.128	2.46	102	1959			
	Kernel	0.208 **	0.930	2.24	139	1959			
Monthly per capita total expenditure (log)	NN Caliper= 0.001 with replacement	0.238 *	0.122	1.96	103	1941	0.282 ***	0.062	2082
	NN Caliper= 0.001 without replacement	0.247 *	0.119	2.07	97	1941			
	Kernel	0.277 ***	0.797	3.48	138	1941			

Note: * Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.
N_T is the number of observations in the treated group
N_C is the number of controls matched with treated observation
SE is Standard Error

The impact of migration on food security using FCS is presented in Table 3.7. FCS is a composite score that captures the frequency of weighted diet diversity. Estimating the impact of migration on FCS, as in the first panel of Table 3.7, the ATT shows the significant impact of migration on FCS in three different matches. The estimates show that MSHs significantly increase the FCS range from 5.6 to 6.9 (composite score). This increase corresponds to 30 per cent and 37 per cent of standard deviation of the FCS.

The increase in the composite index of the FCS implies that dietary diversity and the frequency of consumption increases among MSHs. Migration contributes to the increase in food expenditure as well as the current household status of food security of MSHs. The OLS method shows consistent estimates in terms of significant levels and positively increases the FCS by 4.2 (composite score). This slight difference in the FCS impact between PSM and OLS can be explained from the data. Almost 76 per cent of MSHs are categorised into the acceptable group, but only 16 per cent are borderline and 7 per cent are poor. With this situation, if, after matching, the match sample is comprised of those with high FCSs, then averaging over this subset of our observations leads to a higher average effect of migration on FCSs compared to the result estimated using the OLS method.

To obtain further analysis of the outcome of migration on a composite score of the FCS, the second panel of Table 3.7 shows an estimation of the impact of migration on the probability of the FCS group—acceptable, borderline or poor. The outcome variable is constructed as a binary variable. For the FCS to be acceptable, households with an FCS index over 42 are assigned ‘1’; otherwise, they are assigned ‘0’. In FCS-borderline, the outcome variable is a binary of ‘1’ if households have an FCS index from 28.5 to 42; it is ‘0’ otherwise. In FCS-poor, the outcome variable is a binary of ‘1’ if households have an FCS index that is a maximum of 28; it is ‘0’ otherwise.

The ATT for the FCS-acceptable shows that having at least one migrant in the household significantly increases the probability of them being categorised as households in the FCS-acceptable group by 13 to 18 per cent. The OLS estimation shows a similar result, with a 12 per cent increase in probability. The estimation shows that migration increases the chances of having an FCS of more than 42 (composite index). This positive outcome is supported by insignificant estimates of the probability of a household being in the FCS-borderline and FCS-poor group. Migration is insignificant in contributing to the chances of being in the second and third group of food security.

The findings in the second set of outcomes hint at two positive results that migration has on HFS. Migration not only increases the composite index of the FCS but also increases the probability of being categorised in the highest group of food security status. This positive outcome of migration on food security is in line with earlier studies conducted on Vietnam, in which households maintained their food security through short-term migration (Nguyen & Winters 2011); on Burundi, in which remittances were found to have strong effects on food security (Fransen & Mazzucato 2014); and on the rural district of Tanzania, in which peasant migration was found to positively contribute to food security (Tageje 2014).

An estimation of the impact of migration on food diversity outcomes is presented in Table 3.8. The evaluation is estimated by regressing migration on 10 sets of food groups. In this estimation, a counterfactual approach uses three matching algorithms to produce a consistent estimate with the OLS method. The results show that MSHs significantly increase food expenditure in six out of 10 food groups. Migration of household members increases the expenditure of six out of 10 food groups: vegetables and fruits, dried food, spices, sugar and beverages, oils and snacks (prepared food eaten at home). An estimation on the third set of outcomes supports a positive outcome on the

second set of outcomes. Migration not only enables MSHs to have increased access to food and food utilisation (as captured in the FCS) but also increases food diversity.

In terms of household diversity, migration may produce positive and negative effects on the habits of household diets. Migration may change a household habit to a better or poorer diet, such as eating more high-calorie food or low nutrient foods (Zezza et al. 2011). An increase in liquidity and time allocation are the reasons for changes in food consumption patterns. Consumption of prepared food (such as snacks) eaten at home or eaten out increases due to the absence of a migrant mother. Among 10 food groups, the expenditure on snacks (prepared food eaten at home) shows the highest increase. The PSM method shows that MSHs significantly increase expenditure on snacks (prepared food eaten at home) from 32 to 58 per cent. Expenditure on sugar and beverages also shows a high increase. Re-estimation the main model, focusing on the group of households where the migrant is not the mother/wife show the same pattern that consumption of prepared food (such as snacks) eaten at home increases. Migrant sending household with present mother/wife shows similar pattern of increasing consumption of prepared food (such as snacks) due to the probability that mother/wife have to do double task as both father/husband and mother/wife such that time allocation in preparing homemade food is limited.

This result supports earlier findings that show a shift in dietary habit of MSHs towards less nutritious options. Remittances do not transfer into long-term nutritional effects in Ecuador (Anton 2010), poorer diet quality occurs among children who stay behind in Tonga (Gibson, McKenzie and Stillman 2011), household consumption shifts to less nutritious foods in Ghana (Karamba, Quiñones and Winters 2011) and the probability of childhood obesity among older boys increases due to international migration from Mexico (Damon & Kristiansen 2014).

Table 3.7: Impact of Migration on FCS (PSM and OLS)

	PSM Estimates (Average Treatment of the Treated/ATT)						OLS Estimates		
	Matching Algorithm	Difference	SE	t-test	N_T	N_C	B	SE	N
FCS	NN Caliper = 0.001 with replacement	6.859 **	2.916	2.35	107	1975	4.260 **	1.618	2117
	NN Caliper = 0.001 without replacement	6.861 **	2.806	2.44	97	1975			
	Kernel	5.549 ***	1.885	2.94	139	1975			
FCS-acceptable	NN Caliper = 0.001 with replacement	0.149 **	0.702	2.13	107	1975	0.123 **	0.039	2117
1 = if HH has FCS > 42; 0 = otherwise	NN Caliper = 0.001 without replacement	0.185 ***	0.066	2.81	97	1975			
	Kernel	0.131 ***	0.045	2.93	139	1975			
FCS-borderline	NN Caliper = 0.001 with replacement	-0.065	0.062	-1.05	107	1975	-0.082 *	0.035	2117
1 = if HH has FCS > 28 and < = 42; 0 = otherwise	NN Caliper = 0.001 without replacement	-0.103	0.058	-1.78	97	1975			
	Kernel	-0.087	0.039	-2.23	139	1975			
FCS-poor	NN Caliper = 0.001 with replacement	-0.084	0.489	-1.72	107	1975	-0.040	0.026	2117
1 = if HH has FCS < = 28; 0 = otherwise	NN Caliper = 0.001 without replacement	-0.082	0.045	-1.82	97	1975			
	Kernel	-0.044	0.298	-1.47	139	1975			

Note: FCS = food consumption score; HH = household; NN = nearest-neighbour.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.
N_T is the number of observations in the treated group
N_C is the number of controls matched with treated observation
SE is Standard Error

Table 3.8: Impact of Migration on Food Diversity (PSM and OLS)

Outcome Variables (Logarithm Monthly Expenditure)	PSM Estimates (Average Treatment of the Treated/ATT)						OLS Estimates		
	Matching Algorithm	Difference	SE	t-test	N_T	N_C	B	SE	N
Staple foods	NN Caliper = 0.001 with replacement	0.242	0.208	1.16	75	1463	0.103	0.122	1572
	NN Caliper = 0.001 without replacement	0.204	0.208	0.98	73	1463			
	Kernel	0.042	0.133	0.32	108	1463			
Vegetables and fruits	NN Caliper = 0.001 with replacement	0.260	0.154	1.69	85	1425	0.274 **	0.101	1539
	NN Caliper = 0.001 without replacement	0.335 *	0.153	2.19	78	1425			
	Kernel	0.348 **	0.112	3.11	114	1425			
Dried food	NN Caliper = 0.001 with replacement	0.369 *	0.145	2.55	98	1645	0.296 **	0.091	1770
	NN Caliper = 0.001 without replacement	0.358 *	0.139	2.56	95	1645			
	Kernel	0.317 **	0.099	3.20	123	1645			
Meat and fish	NN Caliper = 0.001 with replacement	0.189	0.156	1.22	91	1596	0.021	0.101	1712
	NN Caliper = 0.001 without replacement	0.182	0.156	1.17	89	1596			
	Kernel	0.133	0.112	1.19	116	1596			
Dairy products	NN Caliper = 0.001 with replacement	-0.216	0.175	-1.23	77	1234	0.0749	0.108	1340
	NN Caliper = 0.001 without replacement	-0.227	0.173	-1.31	72	1234			
	Kernel	0.140	0.121	1.15	103	1234			
Spices	NN Caliper = 0.001 with replacement	0.200	0.145	1.38	91	1799	0.219 *	0.093	1915
	NN Caliper = 0.001 without replacement	0.226	0.140	1.62	86	1799			
	Kernel	0.273 *	0.104	2.63	116	1799			
Sugar and beverages	NN Caliper = 0.001 with replacement	0.323 *	0.133	2.43	92	1735	0.236 **	0.083	1862
	NN Caliper = 0.001 without replacement	0.421 **	0.133	3.15	87	1735			
	Kernel	0.247 **	0.885	2.80	125	1735			
Oils	NN Caliper = 0.001 with replacement	0.279 +	0.142	1.96	68	1377	0.216 *	0.095	1472
	NN Caliper = 0.001 without replacement	0.287 +	0.141	2.03	65	1377			
	Kernel	0.275 *	0.103	2.67	94	1377			
Snack (prepared food eaten at home)	NN Caliper = 0.001 with replacement	0.582 *	0.211	2.76	46	602	0.402 **	0.146	720
	NN Caliper = 0.001 without replacement	0.540 *	0.205	2.63	45	602			
	Kernel	0.316 +	0.156	2.02	74	602			
Food-out (prepared food eaten away from home)	NN Caliper = 0.001 with replacement	0.307	0.371	0.83	14	327	-0.006	0.182	425
	NN Caliper = 0.001 without replacement	0.254	0.373	0.68	13	327			
	Kernel	-0.206	0.200	-1.03	54	327			

Note: * Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.,
N_T is the number of observations in the treated group
N_C is the number of controls matched with treated observation
SE is Standard Error

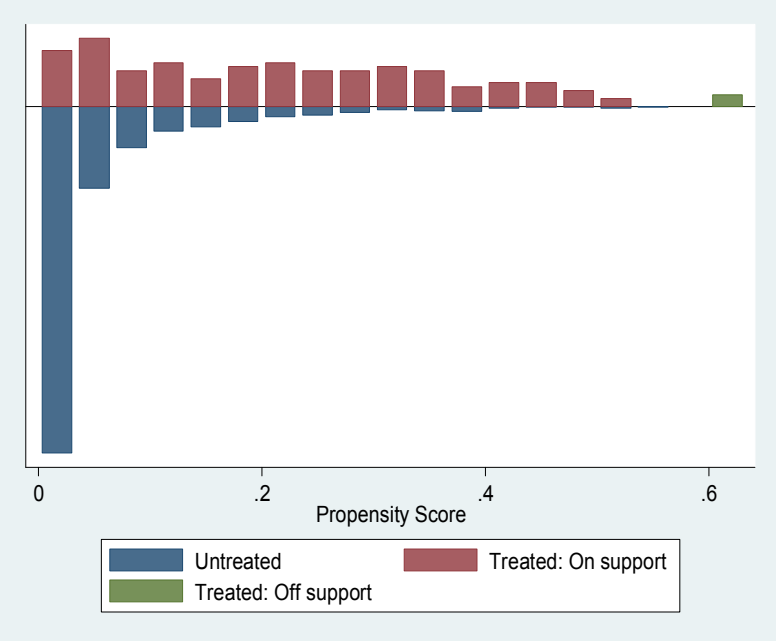

Figure 3.5: Histogram of Propensity Scores of Treatment versus Control Group

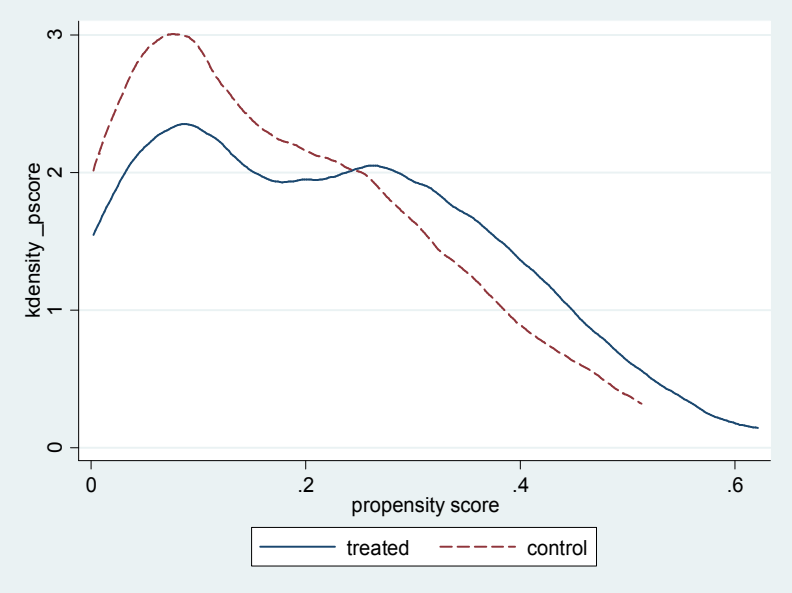

Figure 3.6: Kernel Graphs of Propensity Score for Treated and Control Group

3.6 Conclusion

This paper has evaluated the impact of migration on food expenditure and food security indicators in a region with high vulnerability to food insecurity. Despite mixed

evidence reported in the literature on the outcomes of migration for MSHs regarding expenditure, by focusing on food expenditure outcomes, this paper offers new insights on HFS using FCS as an indicator as suggested in the WFP.

The findings in this paper point towards migration having positive outcomes, as illustrated by three sets of outcomes. The first set of outcomes show that migration increases food expenditure and the total expenditure of MSHs. The second set of outcomes show that MSHs not only experience an increase in food expenditure but also food security status; in addition, they are likely to be in the first group for HFS. The positive contribution of migration to HFS can be translated into the view that migration helps MSHs to manage affordability and vulnerability to food price shocks. The third set of outcomes show that migration resulted in an increase of at least 60 per cent in the diversity of food. However, migration also creates poorer diet habits as expenditure on snacks (prepared food eaten at home) increases significantly, followed by sugar and beverages, and dried food.

IFLS East 2012 makes it possible to investigate the impact of migration on food expenditure as well as food security by combining food frequency and food expenditure modules. As the first dataset to utilise a household survey covering seven provinces in eastern Indonesia, this study relies on cross sectional analysis.

The findings from this paper expand the limited amount of literature that has been produced on the eastern region of Indonesia, and help to form better understandings of the outcomes of migration that can be used in designing and implementing policies to maximise the benefits of migration and to minimise the associated costs. Some of the strategies to enhance the positive outcome of migration, and to accelerate poverty alleviation in this less-developed eastern region of Indonesia include the development of

infrastructure, better migration management for international migration, remittance transfer mechanisms, use of remittance to households and migrant protection.

In relation to international migration, based on presidential regulation in 2006, the Indonesian government set a National Board for the Placement and Protection of Indonesian Overseas Workers or Badan Nasional Perencanaan Penempatan dan Perlindungan Tenaga Kerja Indonesia or (BNP2TKI) which mandated to optimize the benefit of employment programs and protection for Indonesian overseas workers. Decentralizes services for migrants and migrant sending household in NTB (Nusa Tenggara Barat) province in western part of Indonesia was set up in 2008 by the BNP2TKI. Based on the positive outcomes of migration on migrant sending household in eastern part of Indonesia, government should continue the to set the decentralizes services in all other provinces in eastern part of Indonesia in order to maximize the short- and long-run benefits from the use of remittances to households, communities, and the economy.

3.7 Appendix

This section provides a summary of the statistics of three sets of outcomes. Table 3.9 provides a summary of the statistics of food expenditure outcomes. The summary of statistics on HFS outcomes using calculated FCSs are presented in Table 3.10. Table 3.11 is a summary of statistics showing food diversity outcomes (expenditure on 11 food groups in a logarithm of monthly expenditure). Table 3.12 presents results from the balance tests for PSM. Table 3.13 presents an example of the FCS calculation based on the WFP's *Comprehensive Food Security and Vulnerability Analysis Guidelines* (WFP

2009). Table 3.14 contains the food consumption groups with corresponding FCS thresholds for Indonesia based on Indonesia FNSMS.

Table 3.9: Summary Statistics Food Expenditure and Total Expenditure (Indonesian Rupiah, 2012)

	Treated (MSHs)				Control (non-MSHs)			
	Mean	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
Monthly expenditure on food (log)	14.20	0.84	8.78	16.76	13.76	1.02	8.37	16.37
Monthly per capita expenditure on food (log)	12.86	0.91	8.08	15.43	12.43	1.03	7.27	15.50
Monthly per capita total expenditure (log)	13.63	0.83	11.30	15.77	13.16	0.92	9.90	16.07
N	331				2216			

Table 3.10: Summary Statistics Showing HFS Outcomes

	Treated (MSHs)				Control (non-MSHs)			
	Mean	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
FCS	56.36	18.66	13.0	100.5	48.18	19.62	2	108
FCS-acceptable group	63.72	14.46	42.5	100.5	61.57	13.98	42.5	108
FCG-borderline group	37.42	3.99	28.5	42	35.40	3.95	28.5	42
FCS-poor group	21.85	4.05	13.0	27.5	21.01	5.21	2	28
FCS-acceptable (1 = if household (HH) has FCS > 42; 0 = otherwise)	0.761	0.427		1	0.574	0.494	0	1
FCS-borderline (1 = if HH has FCS > 28 and < = 42; 0 = otherwise)	0.169	0.375	0	1	0.259	0.438	0	1
FCS-poor (1 = if HH has FCS < = 28; 0 = otherwise)	0.069	0.254	0	1	0.166	0.372	0	1
N	331				2216			

Table 3.11: Summary Statistics Showing Food Diversity Outcomes*

	Treated (MSHs)					Control (non-MSHs)				
	Mean	**SD**	**Min**	**Max**	**N**	**Mean**	**SD**	**Min**	**Max**	**N**
Staple foods	12.28	1.26	8.37	14.98	273	12.28	1.21	9.06	15.28	1633
Vegetables and fruits	11.89	1.00	9.06	15.28	277	11.44	1.13	8.37	14.47	1607
Dried food	11.57	0.96	9.06	14.41	303	11.25	1.02	7.68	14.48	1845
Meat and fish	12.28	1.12	8.77	15.32	289	12.02	1.09	9.06	15.41	1795
Dairy products	11.59	1.12	8.55	14.26	244	11.36	1.10	8.37	14.72	1389
Spices	11.44	0.97	8.37	14.60	291	11.19	1.00	8.01	14.43	2014
Sugar and beverages	11.75	0.90	8.37	14.25	310	11.53	0.86	8.37	15.02	1952
Oils	11.34	0.87	9.29	13.94	235	11.19	0.87	8.37	13.92	1536
Snacks (prepared food eaten at home)	11.65	1.11	9.06	15.18	164	11.31	1.12	8.37	14.92	725
Food-out (prepared food eaten away from home)	11.87	1.15	9.76	14.70	114	11.57	1.16	8.37	14.92	409

Note: * = expenditure on 11 food groups in logarithm of monthly expenditure.

3.7.1 Covariates Balance

Table 3.12 presents results from the balance tests for PSM. It shows the mean, standardised bias, reduction in bias, t-test and p-value of each of the covariates for the

treatment and control groups. The test shows a significant improvement in balance and suggests that matching helps to reduce the bias associated with observable characteristics. Except for two covariates, most household characteristics show more than an 85 per cent reduction in bias. The matching will cause a reliable regression adjustment since the standardised difference in the matched sample is much smaller than 50 per cent as suggested in Rubin (2001). The bias of the age of the head of household drops as much as 89.1 per cent after matching, and other covariates among the head of household characteristics also display similar rates of reduction. Covariates imply that the mean differences between the treatment and control groups in the matched sample do not differ significantly at 10 per cent significance level. The matched sample shows a significant reduction in bias since the mean value drops from 46.5 to 6.1.

3.7.2 Example Calculation of FCS and Household Food Consumption Groups

1. Using standard seven-day food frequency data, group all the food items into specific food groups.
2. Sum all the consumption frequencies of food items of the same group and recode the value of each group above seven as seven.
3. Multiply the value obtained for each food group by its weight and create new weighted food group scores.
4. Sum the weighed food group scores creating the FCS. The most diversified and best consumption with maximal FCS at 112 means that all food groups are eaten seven days a week.
5. Using the thresholds for Indonesia, households are categorised into three food consumption groups: poor, borderline and acceptable food consumption.

Table 3.12: Covariates Balance Before and After Matching

Variable	**Mean-treated**	**Mean-control**	**% Bias**	**% Reduction in Bias**	***t***	***p***
Head of household (HH) characteristics:						
Age	36.408	35.57	7.5	89.1	0.77	0.442
Sex	0.901	0.852	15.0	2.3	1.26	0.208
Marital status (single, married, divorced)	1.951	1.979	-8.0	80.0	-0.63	0.527
Type of work (1 = worker, 0 = self-employed)	0.648	0.598	10.6	86.5	0.86	0.393
HH characteristics:						
HH size	3.338	3.323	0.7	98.5	0.07	0.946
Number of children under 5 years	0.591	0.605	-1.8	85.9	-0.16	0.873
Number of children between 6 to 18 years	0.732	0.775	-3.7	92.3	-0.33	0.744
Number of members to finish primary school	2.774	2.767	0.4	98.8	0.04	0.970
Own house (1 = yes, 0 = no)	0.331	0.309	4.8	95.5	0.38	0.704
Number of rooms in house	4.669	4.563	4.9	56.9	0.40	0.686
Use electricity (1 = yes, 0 = no)	0.979	0.972	2.4	95.9	0.38	0.703
Own land (1 = yes, 0 = no)	0.232	0.232	0.0	100	0.00	1.000
Own non-farm family business (1 = yes, 0 = no)	0.507	0.478	5.7	68.7	0.47	0.636
Community characteristics:						
Infrastructure of road and phone in the last 5 years	0.309	0.373	-14.9	50.9	-1.12	0.262

Note: A summary of the distribution of the absolute bias shows that:
Before matching: mean bias = 46.5; median bias = 42.9.
After matching: mean bias = 6.1; median bias = 4.9.

Table 3.13: Example of FCS Calculation*

Food item	Food group	Weight (A)	Number of days eaten in a week (example) (B)	FCS = (A) x (B)
Potatoes, sweet potatoes and cassava	Cereals, tubers and root crops	2	7	14
Beans, peas, cashew nuts and groundnuts	Pulses	3	2	6
Vegetables, leaves and relish	Vegetables	1	3	3
Fruits	Fruit	1	1	1
Beef, goat, pork, poultry, eggs and fish	Meat and fish	4	0	0
Milk, yoghurt and other dairy	Milk	4	1	4
Sugar and sugar products	Sugar	0.5	4	2
Oils, fats, and butter	Oil	0.5	2	1
Condiments	Condiments	0	0	0
Composite score				**31**

Note: * Based on *Comprehensive Food Security and Vulnerability Analysis Guideline*s (WFP 2009).
Source: (WFP 2009)

Table 3.14: Food Consumption Groups with Corresponding FCS Thresholds for Indonesia

Food Consumption Groups	FCS	Description
Poor	0–28	Household consumes staple (7 days), vegetables (5–6 days), sugar (3–4 days), oil/fat (1 day) in a week, animal proteins are absent.
Borderline	28.5–42	Household consumes staple (7 days), vegetables (6–7 days), sugar (3–4 days), oil/fat (3 days), meat/fish/egg/pulses (1–2 days) in a week, dairy products are absent.
Acceptable	> 42	The same with borderline group, but with more number of days in a week eating meat, fish, eggs and oil, and complemented by other foods such as pulses, fruits and milk.

Source: WFP (2009).

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Chapter 4: Adult Child Migration and Elderly Parent Health—Recent Evidence from Indonesian Panel Data

4.1 Introduction

Migration as a family strategy brings many benefits and consequences to the livelihood of migrants at the destination and MSHs at the origin. As postulated by the NELM, migration is a household decision with regard to risks and potential outcomes (Stark & Bloom 1985). Migration increases family incomes, eases credit constraints, reduces risk and volatility, and promotes productive investment in physical and human capital. The effect of migration on health works through the income effect of remittance, which increases household consumption and improves living standards, investment in health-related expenditure and health utilisation (Amuedo-Dorantes, Pozo and Sainz 2007). However, the potential loss of income and family disruption associated with the absence of migrants' must also be considered.

Increasing life expectancy and longevity are reported not only in high-income countries but also in low- and middle-income countries. Indonesia had nearly 21.68 million elderly citizens in 2015 comprises 8.49 percent of its total population and projected to increase 15.77 per cent in 2035 (BPS 2015). Out-migration is considered a contributing factor to the ageing population in some Indonesian regions, and this may worsen the dependency ratio (Ananta 2012). Although the ageing population is increasing, the Indonesian government did not identify this as an important policy issue until it raised the normal pension age from 56 years in 2016 gradually rising to 65 by 2043, increasing by one year every three years (BPJS ketenagakerjaan, 2015) as a response to increasing life expectancy. Most low- and middle-income countries place a high priority on maternal and child health and combating leading infectious diseases in

their health-related policy. Consequently, there is limited information on the health of aged individuals, particularly in Indonesia.

With a long history of rural–urban movement, out-migration to cities is a relatively unconstrained process in Indonesia. Migration from rural areas to larger cities has contributed to a 25 per cent increase in urban population growth in the last 20–30 years (Meng & Manning 2010). The out-migration of younger household members to urban areas, large cities and even other countries has become a characteristic of out-migration in Indonesia. Younger people aged 15–29 dominate out-migration in Indonesia (Kreager 2006) and this has both positive and negative consequences. Their remittance supports the welfare of household members left behind; however, out-migration also leaves elderly family members with a lack of labour and less support, which might negatively affect their health. Therefore, the impact of adult child migration on parent's health should be investigated.

This study contributes to the existing literature by examining the impact of migration on MSHs in several ways. First, it investigates the impact of adult child labour migration on the health of parents left behind in Indonesia, one of the world's most populated countries and one with increasing life expectancy. With limited access to social security and social services for the elderly, the consequences of the increasing out-migration of adult children for parents' health are important to investigate. Second, this study analyses several indicators of health: self-rated health status, number of unhealthy days, visits to outpatient care, episodes of acute morbidity and whether individuals are on medication. Third, several possible differentials on parental health outcomes are considered: migrant's gender, health of parents aged over 50 and whether parents live in rural areas. Fourth, this study analyses a range of potential transmission channels.

Unlike previous studies on Indonesia, this study applies a long period of panel data using four waves of the IFLS, including the 2014 survey, to analyse the causal relationship between migration and health. This chapter applies FE estimation to control for endogeneity. The FE method controls for specific characteristics of respondents that do not vary over time and have a constant effect on the outcome, such as traits, genetics and personality. Relevant unobserved characteristics related to migration prerequisites, such as motivation for migration, are time-invariant. With an appropriate panel design and using the FE method, possible selection bias that comes from time-invariant unobservable characteristics can be addressed.

4.2 Overview of Existing Literature

The monetary effect of remittance is expected to have a positive effect on the health of family members left behind through an improvement in living standards. However, migration can be detrimental to the health status and emotional wellbeing of MSHs (Deb & Seck 2009) and such health outcomes may depend on the duration of migration (Resosudarmo et al. 2010). Contradictory evidence is shown in studies that focus on the health of elderly parents. A positive impact of adult child migration on parental health is reported in Kuhn, Everett and Silvey (2011). Adult child migration is also reported to have a positive impact on parents aged over 60 in rural China (Chang et al. 2016). However, migration can also be a source of stress and loss of social support for MSHs. Parents and partners left behind are more susceptible to stress-related health impairments such as hypertension and depressive symptoms (Lu 2012). Studies using data from China note that poorer self-assessed health is reported by parents left behind (Huang, Lian & Li 2016; Ao, Jiang & Zhao 2016). Similar findings have been reported in Ireland by Mosca and Barrett (2016) who noted that depressive symptoms and loneliness increased among the mothers of migrant children.

A distinct challenge in investigating the impact of migration is identifying migration selection. Migration studies should take into account that migrants are self-selecting. Migrants may come from families with greater social and economic resources than families without migrants; this self-selection will effect the health outcome of migration. An early study that considered the possibility of self-selection was undertaken by Borjas (1987) who highlighted the need to address the issue of selection in the analysis of both internal and international migration (see also Lucas, 1997). McKenzie, Gibson and Stillman (2010) found that migrants from Tonga were positively selected in both observed and unobserved skills. A 'healthy migrant effect' has been considered in studies of health outcomes, indicating that migrants are typically healthier than the wider population of their community (Marmot, Adelstein and Bulusu 1984; Abraido-Lanza et al. 1999; Jasso et al. 2004; Wingate & Alexander 2006). Other studies also highlight the fact that international migrants are generally healthier than the population at the destination, although their health eventually deteriorates (Antecol & Bedard 2005; Fennelly 2005).

Self-rated health (SRH) is a widely used subjective assessment of health status in the study of elderly health. It is also considered a good method of assessing overall wellbeing and is in line with the World Health Organization's (WHO) definition—namely, that health is more than the absence of disease but also includes physical, mental and social wellbeing. Despite doubts about the validity of self-reported health, such assessments in the 2002 World Health Survey proved useful for within-country epidemiological investigations, even in low-income settings (Subramanian, Huijts & Avendano 2010). The WHO and the European Union Commission (EUC) have recommended SRH in health monitoring (de Bruin, Picavet & Nossikov 1996). Hermalin (2002) highlighted that older persons appraised both physical and mental health in rating their health status. Objective health outcomes as well as mortality and morbidity have

been well predicted by self-reported health indicators (Idler & Benyamini 1997; Franks, Gold & Fiscella 2003; Van Doorslaer & Jones 2003). SRH has been shown to predict both chronic disease (Shadbolt 1997) and recovery from major medical events (Wilcox, Kasl & Idler 1996). SRH can serve as a global measure of health status since it is consistent with objective health status (Wu et al. 2013).

Previous studies have used many indicators to measure the health status of elderly parents. Illness instances and self-reported health are two measures used in Chang et al. (2016). Their study found that adult child migration significantly decreases illness instances and results in relatively higher self-reported elderly health. SRH, activities of daily living (ADL), and mortality are three outcomes used in Kuhn, Everett and Silvey (2011), who found that elders with migrate-out adult show better health compared to elders without child migration. Meanwhile, Lu (2012) reports psychosocial costs of out-migration using the indicators of high blood pressure and depressive symptoms.

4.2.1 Migration and Health in the Indonesian Context

Very few studies investigate the outcomes of migration in the Indonesian context. Moreover, studies that focus on health outcomes are very limited. Using an Indonesia setting, Deb and Seck (2009), Resosudarmo et al. (2010) and Lu (2010) investigated several health outcomes of migrants and their households. Focusing on internal migration and measuring body mass index (BMI), self-reported illness and emotional wellbeing for adults within the household, Deb and Seck (2009) found that migration can be detrimental to health and emotional wellbeing. Meanwhile, Resosudarmo, Yamauchi & Effendi, 2010 found that migration had an insignificant effect on the BMI of adults within MSHs; they also stressed that the health outcomes of rural–urban migration depended on the duration of the migration. Measuring both the physical and psychological health of migrants and

their families, Lu (2010) found that depressive symptoms increased because of migration between rural–urban areas. Lu (2010) also highlighted the multiple offsetting influences of migration; for example, while migration may improve living standards, there are factors that hinder potential health gains, such as increases in work-related stress and under-consumption because of the remittance obligations.

There are two studies that focus on the impact of migration on the health of family members left behind in Indonesia that use IFLS data. Using indicators of hypertension and depressive symptoms, and applying FE and a lagged dependent variable, Lu (2012) reported a negative impact of migration on the health of adults left behind. Focusing on the health of older family members left behind, and investigating SRH, ADL and mortality, Kuhn, Everett and Silvey (2011) reported a different finding; using PSM, they found a positive association between adult child migration and the health status of elderly parents left behind.

This study complements this limited literature by using very recent data over a longer period of time anda panel design, exploring the impact of migration on several indicators of health for parents: SRH status, number of unhealthy days, visits to outpatient care, episodes of acute morbidity and being on medication. The estimation is performed using FE to addresses possible selection bias caused by both observable and time-invariant unobservable characteristics.

4.3 Data

4.3.1 Data Source

The data used in this study come from the 1997, 2000, 2007 and 2014 IFLS. The IFLS is the only ongoing longitudinal survey in Indonesia that collects extensive information at individual, household and community levels. It contains information on

large-scale socio-economic, health, household demographic and economic characteristics, consumption and health expenditures, and access to health care facilities.

The fifth-wave IFLS was completed between late 2014 and early 2015; around 16,204 households and 50,148 individuals were interviewed. The IFLS seeks longitudinal data with low attrition (Strauss et al. 2004). The re-contact rates of each wave of the IFLS are as high as, or higher than, most longitudinal surveys in the US and Europe (Strauss, Witoelar & Sikoki 2016). The surveys conducted in 2000 and 2007 included interviews with over 90 per cent of the households that had participated in previous waves (Strauss et al. 2009). After its first wave, IFLS managed to re-contact 87.6 per cent of households in the next four waves (Thomas et al. 2012). Almost 88 per cent of respondents aged over 15 in the first-wave IFLS were able to be recontacted in the fourth wave (Kim et al. 2015).

The first-wave IFLS occurred in 1993 and covered 83 per cent of the Indonesian population living in 13 of the nation's 26 provinces. When the second wave was conducted in 1997, IFLS questionnaires were modified to capture information on topics of special concern to Indonesia and to reflect the nation's distinctive social, economic and policy environment. New measurements were added in the health module, which measured the health of all family members. From IFLS 1997, new data on particular topics has been collected, such as decision-making in the household, community participation and women's choices about pregnancy and childbirth (Frankenberg & Thomas 2000). For these reasons, this study use IFLS data from 1997 to 2014.

As part of its analysis of basic household characteristics, the IFLS roster module contains information on all household members who live or do not live in the household as well as the reason that members do not live in the household. My study combines the information on absent householders with the migration module that addresses movement

since the age of 12 and any movement outside the village for more than six months. Based on information from these two modules, it is possible to identify MSHs. Detailed information on health is collected from all IFLS respondents; a specific module focuses on health measurements and has a nurse as one of the interviewers. As mentioned, I restrict the data in this study to four waves (1997–2014) from which all data on variables of interest are obtained. Table 4.1 presents number of parents from migrant sending households (MSHs) and non-migrant sending households (Non-MSHs) in each year of panel dataset.

4.3.2 Dependent and Independent Variable Measures

4.3.2.1 Independent Variables

As a key explanatory variable, parents with migrant children are identified after adult child migrants are defined. An adult child migrant is a household member aged at least 15 years who is not staying in the household at the time of survey, has been away for six or more months, moved out for work reasons and to at least a different district. Table 4.2 presents the characteristics of adult child migrants based on IFLS 1997, 2000, 2007 and 2014. Most adult child migrants are males between the ages of 15–30; most have finished at least high school and migrate to areas outside their own province. At least 74.37 per cent of parents have one adult child in our sample; therefore, the analysis does not differentiate between parents who have one or more than one adult child migrant. Parents with migrant children are defined as parents with at least one adult child migrant. MSHs are households that have at least one migrant. After defining MSHs, several characteristics of individual parents and households can be obtained.

Table 4.1: Households & Parents of MSHs and Non-MSHs in IFLS 1997, 2000, 2007 &2014

Year	1997	2000	2007	2014
Parents of MSHs	1047	974	1192	836
Number of MSHs	592	550	702	503
Parents of Non –MSHs	4088	4874	5197	5773
Number of Non –MSHs	7025	9860	12752	15267

Source: IFLS 1997, 2000, 2007 & 2014

Table 4.2: Sample Characteristics of Adult Child Migrants

Characteristics		Number of adult child migrants	Percent
Age:	15–30 years	2567	94.12%
	> 30years	162	5.88%
Sex:	Male	1821	66.73%
	Female	908	33.27%
Education:	Finish elementary school	737	27.01%
	Finish high school	1802	66.03%
	Above high school	190	6.96%
Migrate to:	Within the same province	702	25.72%
	Outside province	2027	74.28%
Number of migrants in MSHs:	One adult child migrant	2031	74.42%
	More than one migrant child	698	25.58%

Source: IFLS 1997, 2000, 2007 & 2014

4.3.2.2 Outcome Variables

To capture parental health in the analysis, the five outcomes of interest are:

- SRH status
- the number of unhealthy days
- the number of visits to outpatient care
- episodes of morbidity symptoms

- being on medication for anemia, high blood pressure, diabetes or cholesterol.

In SRH-current, the respondent is asked: 'In general, how is your health?' There are four response categories: '4 = unhealthy', '3 = somewhat unhealthy', '2 = somewhat healthy' and '1 = very healthy'. Only 0.7 per cent of respondents answered 'unhealthy'; therefore, the third and fourth categories are combined.[1] The responses of SRH measures are then reversed to create an increasing ordinal with '1' representing poor health and '3' representing good health.

The second measure of parental health status is unhealthy days. The IFLS measures unhealthy days as the number of days of primary daily activities missed due to poor health within the last four weeks. The term 'unhealthy days' follows the definition used by the US Centers for Disease Control and Prevention (CDC), in which 'unhealthy days are an estimate of the overall number of days during the previous 30 days when the respondent felt that either his or her physical or mental health was not good' (CDC 2000). Based on their survey, adult respondents reported an average of 24.7 healthy days or 5.3 unhealthy days. Constructing a binary variable, this study defines parents as having poor health if they reported more than five unhealthy days within the last four weeks. Using unhealthy days, there are more parents with poor health among those without migrant children compared to those with migrant children.

Outpatient care refers to whether respondents had visited a health centre for outpatient care, such as a public hospital, puskesmas (subdistrict-level health centre), private hospital, clinic, health worker or doctor's practice, or had been visited by a health worker or doctor in the last four weeks. I define any visit to outpatient care within the last four weeks as '1' and otherwise as '0'. Our sample shows that 14.35 per cent of parents

[1] Following the practice in Frankenberg and Jones (2004).

of adult child migrants visited outpatient care, and 16.55 per cent of parents of non-migrants visited outpatient care in the previous four weeks.

The fourth measure of parental health shock is the incidence of acute morbidity symptoms. By using morbidity, I indirectly capture the psychological distress caused by parent illnesses, as respondents with a high level of psychological distress are more likely to record symptoms (Kooiker 1995). IFLS assesses acute morbidity by asking respondents: 'Did you have any symptoms of acute morbidity during the past 4 weeks?' The symptoms include headache, cough, fever,difficulty in breathing, blood pressure, wound/injury, painful or swollen joints, diarrhoea and nausea/vomiting. Based on IFLS data, on average, adults reported three incidents of morbidity symptoms within the previous month. I defined parents as having poor health as '1' if they reported at least seven incidents of symptoms in the last four weeks and '0' otherwise. Our sample shows that 9.06 per cent of parents of adult child migrants had at least seven episodes of morbidity symptoms, while 11.29 per cent of parents of non-migrants had at least seven episodes of morbidity symptoms over the previous month.

Being on medication is the fifth measure of the health status of parents of adult child migrants. In the health module of the IFLS, two health workers (nurses) conduct physical health assessments. The IFLS assesses whether respondents are taking medicine for anemia, high blood pressure, diabetes or cholesterol. After constructing a binary variable in which the value '1' was given if respondents were taking medicine for either one of the four illness and '0' otherwise, our sample shows that 3.12 per cent of parents of adult child migrants are on medication, while 11.29 per cent of parents of non-migrants are on medication for anemia, high blood pressure, diabetes or cholesterol.

Details of the dependent variables measured are described in Table 4.3. The health characteristics of sample parents with and without migrant children are reported in Table 4.4.

To observe possible differentials on parental health outcomes, this study analysed the impact of adult child migration on five different subsamples. In particular, I analyse the impact of migration for the group of all adult child migrants, the groups of son and daughter migrant (in order to consider the possible impact of migrant's gender on parental health outcomes)**,** the group of migrants with parents older than 50 (given the increasing elderly dependency ratio)**,** and migrants from rural areas, which are considered the poorest areas in the country**.** The mean and standard deviation of parents with and without migrant children for each sub sample are presented in table 4.32-4.35.

Table 4.3: Measurement of Dependent Variables

Variable	Question in the survey:	Choice of answer	After reordering and revision
Self-rated health status	'In general, how is your health?'	1 = very healthy 2 = somewhat healthy 3 = somewhat unhealthy 4 = unhealthy	1 = somewhat unhealthy and unhealthy 2 = somewhat healthy 3 = very healthy
Unhealthy days	'During the last four weeks, how many days of your primary daily activities did you miss due to poor health?'	unit: number of days	1 = had more than 5 unhealthy days in the last 4 weeks 0 = had 5 or less unhealthy days in the last four weeks
Outpatient care	'Have you visited a public hospital, puskesmas, private hospital, clinic, health worker or doctor's practice or been visited by a health worker or doctor in the last 4 weeks'	1 = yes; 0 = no	1 = one or more visits 0 = no visits
Morbidity	'Did you have any symptoms of acute morbidity during the past 4 weeks such as: headache, cough, fever, difficulty in breathing, blood pressure, wound/injury, painful or swollen joints, diarrhoea, nausea/vomiting, etc.'	1 = yes; 0 = no	1 = had 7 or more morbidity symptoms 0 = had less than 7 morbidity symptoms
On medication	'Are you taking medicine for: either anemia, high blood pressure, diabetes or cholesterol?'	1 = yes; 0 = no	1 = if taking medicine for either anemia, high blood pressure, diabetes or cholesterol 0 = no

Source: IFLS 1997, 2000, 2007 & 2014

Table 4.4: Outcome Variable, Parents with and without Migrant Children using Panel Data IFLS 1997, 2000, 2007 and 2014

Outcome variable		Parent with migrant children (%)	Parent without migrant children (%)
Self-rated health	Unhealthy	17.67	19.52
	Healthy	72.99	70.81
	Very healthy	9.34	9.67
Visit outpatient care	Yes	14.35	16.55
	No	85.65	83.45
Unhealthy days	> 5 unhealthy days	10.67	11.47
	< = 5 unhealthy days	89.36	88.53
Morbidity	> =7 morbidity symptoms	9.06	11.29
	< 7 morbidity symptoms	90.94	88.71
On medication	Yes	3.12	5.33
	No	96.88	94.67

Source: IFLS 1997, 2000, 2007 & 2014

4.3.2.3 Control Variables

Basic characteristics of parents and MSHs are set as control variables. Basic individual parent characteristics include age and age in quadratic, which captures the depreciation of health capital. Education is measured by years of schooling; more years of education contributes to positive health production (Grossman 1972). Working means that a parent has worked at least one hour to earn income in the past week. BMI is calculated as the parent's weight in kilograms divided by their height in metres squared. Smoking captures risky-health behaviour and is defined as a habit of smoking. Household characteristics are household size, number of adults living in the household and household assets. Life events are also set as control variables because shocks such as death or sickness, loss of a crop or family business, and loss caused by a natural disaster may also affect the health status of parents. Table 4.5 reports the mean and standard deviation of parents with and without migrant children from 1997–2014.

Table 4.5: Mean and Standard Deviation, All Variables with and without Migrant Children using IFLS Panel Data 1997, 2000, 2007 & 2014

Variable	Parents with migrant children		Parents without migrant children	
	Mean	SD	Mean	SD
Outcome variable:				
Self-rated health status	1.916	0.512	1.901	0.531
Unhealthy days	0.106	0.308	0.114	0.053
Outpatient care	0.143	0.350	0.165	0.371
Morbidity	0.090	0.287	0.112	0.316
On medication	0.031	0.173	0.053	0.224
Independent variable:				
Parent age	51.568	9.197	48.884	9.697
Parent age (square)	2743.89	998.85	2483.7	1033.43
Parent education	6.186	3.565	7.407	3.878
Parent work	0.929	0.255	0.951	0.214
BMI	22.43	3.926	23.361	4.165
Smoking	0.327	0.469	0.293	0.455
Household (HH) size	6.912	2.473	6.459	2.454
Number of adults living in households	4.932	1.667	4.528	1.671
Log of HH assets	16.772	1.706	17.219	1.810
Land for farm (yes/no)	0.405	0.491	0.277	0.447
Non-farm family business (yes/no)	0.379	0.485	0.447	0.497
Life events	0.217	0.412	0.187	0.390

Source: IFLS 1997, 2000, 2007 & 2014

4.4 Methodology

4.4.1 Fixed Effects

Some important methodological issues should be considered in evaluating the impact of migration on family members left behind. A selection problem may occur since migrants are not randomly selected. Moreover, some unobservable factors may determine both the decision to migrate and the outcome of interest, which in our case is parental

health. Without taking into account the risk of endogeneity, the OLS will overestimate the effect of migration because it captures the impact of migration as well as the positive attributes of migrants. Several approaches can be used to address endogeneity such as IV, PSM and difference in difference.

Unless adequate controls exist for both observed and unobserved characteristics, in non-experimental studies that determine migration decisions and household outcomes, the estimation results will be biased (McKenzie & Yang 2010). Adult child migrants in our study may come from families with greater socio-economic resources than families without migrants; this self-selection will overstate the parental health outcome of child migration.

The PSM method enables us to construct appropriate comparison groups of migrants and non-migrants; however, it only controls for observables (not unobservables) characteristics. With appropriate instruments, the IV method is able to control for both observables and unobservables. With relevant and valid instruments, the IV method produces estimation results with low bias. However, the PSM method produces better estimates if the IV method uses a weak instrument (McKenzie, Gibson & Stillman 2010). Another method to control for endogeneity is the FE method (Lu & Treiman, 2007; Booth & Tamura 2009).

Taking advantage of the longitudinal nature of the IFLS data, this paper uses the FE estimation technique. The FE method addresses possible selection bias caused by unobservable characteristics and rules out bias caused by omitted variables that have constant effects over time (Angrist & Pischke 2009). The FE method assumes that all relevant unobserved variables, such as motivation for migration or migration prerequisites, are time-invariant and, since variables are differenced out over time, the FE

model removes the unobserved time-invariant variables, enabling the production of unbiased estimates (Kroeger & Anderson, 2014**)**

While the FE method enables researches to control for all non–time varying observable and unobservable characteristics, a time-varying unobservable that comes from an idiosyncratic shock may influence the decision to migrate and may also affect health outcomes. To control for individual-specific heterogeneity and time-varying factors, this study includes a number of relevant confounders in the FE model, including life events that have affected the household and may have caused economic hardship that affected parental health status.

The basic FE regression model used in the estimation is:

$$Y_{it}^{*} = \beta_1 M_{it} + \beta_2 X_{it}' + u_i + \varepsilon_{it} \quad \text{..... (4.1)}$$

where Y_{it}^{*} represents health measures of outcome variables for parent i = 1, ..., *I* at time t = 1, ... *T*; $M_{it}$is the key binary explanatory variable representing being the parent of a migrant; X_{it} is a vector of control variables; u_i represents time-invariant unobserved individual factors assumed to be correlated with the vector of explanatory variables; and ε_{it} is a random time-varying error.

Equation 4.1 is estimated using a linear model. The FE model is the preferred specification in this study. For robustness checks, this study also reports estimation results using different identifying assumptions, pooled OLSs, panel probit and panel ordered probit. The fixed effect instrumental variable (FE-IV) method and result is discussed under sensitivity analysis.

If time-invariant unobserved individual factors do not exist ($u_i = 0$), pooled OLSs produce efficient and consistent parameter estimates. However, if the mean of the

individual effect u_i is different from zero, heterogeneity (individual time-invariant specific characteristics, such as personality, and traits that are not captured in regressors) may lead to violation of the OLS assumptions of exogeneity and homoscedasticity, which means that the pooled OLS estimator will be biased. Estimation methods using panel data models provide a way to deal with these problems; therefore, the FE method estimation result is the reference estimation in this study.

One potential limitation of this method is that FE only controls for time-invariant unobserved characteristics. However, if time-specific random shocks happen, estimates may be biased. A time-varying shock may simultaneously affect both adult children's propensity to migrate and the health status of parents left behind. Shocks to households—such as parental job loss, failure in family business or the loss of a crop of a household's farm caused by a natural disaster—may simultaneously affect children's intention to migrate (to find a better job) and parental health status. Similarly, the loss of a family member due to illness or death may affect parental health status and may, at the same time, increase the chances that a household member will migrate to cover the cost of illness.

For these reasons, I control for a wide set of independent variables, and I include a variable 'life events' to control time-varying random shocks. This variable comes from module two of the IFLS. It includes any events that have affected households and caused economic hardship during the past five years, such as crop losses or the failure of a family business due to natural disasters, a fall in market prices, death or sickness of a householder or other family member, and unemployment of a householder. This variable may help capture the possibility of time-specific shocks. Parental working status and parental BMI are also included as control variables to capture shocks that might affect parental jobs, which, in turn, might affect parental health status. In a study of psychosocial

consequences of internal out-migration using the FE method, Lu (2012) argued that many important unobserved factors, such as previous life exposure to negative events and personal traits, are heritable; therefore, the possible bias that comes from time-varying unobservables is limited.

4.4.2 Fixed Effect Instrumental Variable

The FE model controls for any specific variables that do not vary over time; however, it is possible that time-varying unobserved factors affect the estimation results. One way to address these concerns is to use IV estimation (Yang 2006). The IV method requires the existence of one or more valid instruments. A valid instrument is one that is substantially correlated with the endogenous regressors, i.e., treatment (migration), but not correlated to the outcome (parental health) except through its effect on the endogenous regressor (migration).

The community-level migration rate can be a valid instrument for a child's decision to migrate, as it provides a network to migration. The instrument is the number of migrant at community level per number of people from the same community. IFLS determined community as sub-district region and includes 312 communities that correspond to the 321 enumeration areas and are uniquely identified. Relatives or friends in the destination provide information about jobs and costs, thus inducing more migration. Communities with high migration rates will tend to attract more household members to migrate. Several studies show the importance of migration networks to the decision to migrate (Rozelle, Taylor & de Brauw 1999; Taylor, Rozelle & de Brauw 2003; McCarthy et al. 2006)

4.5 Results and Discussion

Estimation results using pooled OLS, panel ordered probit or probit and panel FE are presented by groups of samples. Estimations are applied for five groups of samples:

all adult child migrants, son migrants, daughter migrants, parents aged 50+ and parents who live in rural area. Tables 4.6–4.10 report estimation results of the impact of child migration on five parental health outcomes. Tables 4.11–4.14 report estimation results of the impact of son migration on four parental health outcomes. Tables 4.15–4.18 report estimation results of the impact of daughter migration on four parental health outcomes. Tables 4.19–4.21 report estimation results of the impact of child migration on three parental health outcomes of parent aged over 50. Tables 4.22–4.25 report estimation results of the impact of child migration on four parental health outcomes of parents who live in rural areas.

4.5.1 All Adult Child Migration and Parental Health Outcomes

Tables 4.6–4.10 report estimation results the impact of all child migration on five parental health outcomes. Each table reports estimation result using OLS, ordered probit or probit, and FE methods. Tables 4.6–4.10 shows that, according to all three estimation methods, adult child migration has a positive impact on the health status of parents left behind.

The FE estimation results show that parent with migrant children increase their SRH status by 0.045 point or 8.8 per cent of the standard deviation (Table 4.6), and are 2.9 per cent less likely to have more than seven episodes of morbidity symptoms (Table 4.7). Parents with migrant children are 1.8 per cent less likely to visit outpatient care (Table 4.8), 1.6 per cent less likely to have more than five unhealthy days (Table 4.9), and 1.5 per cent less likely to be on medication (Table 4.10). The FE method reports consistent estimation results with OLS, ordered probit and probit methods.

Table 4.6 shows that, along with other individual control variables, having at least one migrant child is one of the important factors that determine parental SRH status.

Parental characteristics such as age and BMI significantly affect parental SRH status. Capturing the depreciation of health capital, age shows a negative effect and indicates that older parents are more likely to report poor health status. BMI captures information on individual fitness and health outcomes; the higher the BMI, the more likely parents are to rate their health status highly.

Table 4.7 reports the impact of all child migration on parents' morbidity. Working parents are more likely to have more morbidity symptoms. Large households tend to have less morbidity; however, the greater the number of adults, the higher the number of morbidity symptoms. Having land for farming contributes to parents having fewer morbidity symptoms. Household size, having non-farm family business and life events significantly affect the number of parental visits to outpatient care as presented in table 4.8. Parental age, BMI and smoking are the main individual characteristics that affect the number of unhealthy days as presented in table 4.9. Table 4.10 report the impact of all child migration on parents' likelihood on medication. Smoking and household size are the control variables that significantly affect the likelihood of parents being on medication based on the FE estimation.

Overall, the estimation shows that having at least one child migrant contributes positively to the health status of parents left behind using all five health outcome indicators. Parents of migrants are more likely to have a better SRH status, fewer incidents of morbidity symptoms, fewer numbers of unhealthy days, fewer visits to outpatient care and are less likely to be on medication compared to parents without child migrant. The estimations are consistent in sign, magnitude and significance using pooled OLS, panel ordered probit or probit, and FE methods.

The findings in this study highlight the role of adult child migration in old-age support. Importantly, the absence of adult children does not imply disruption in the traditional systems of health production. The economic transfers of adult child migration bring benefits to the health of the parents left behind (Frankenberg, Lillard, and Willis 2002; Kuhn 2006; Toyota, Yeoh and Nguyen 2007)

4.5.2 Son Migration and Parental Health Outcomes

To estimate the possible impact of gender differences of child migration on the health status of parents, this study examines a sub-sample of son and daughter migration. While male adult household members are primarily responsible for household incomes, female adults are expected to care for parents and perform domestic work; therefore, daughter migration is of interest, as its influence on parental health status may be different from that of son migration.

The impact of son migration on parental health status is presented in Tables 4.11–4.14 using pooled OLS, panel ordered probit or probit, and FE methods. The mean and standard deviation of parents with and without migrant children for son migration presented in table 4.32.

Estimation results using the FE method show that having a migrant son increases parental SRH status by 0.035 point or 6.8 per cent of the standard deviation (Table 4.11). The parents of migrant sons are 2.4 per cent less likely to have more than seven episodes of morbidity symptoms (Table 4.12), and are 2.3 per cent less likely to visit outpatient care (Table 4.13).

Other control variables, such as parental BMI, significantly affects parental SRH status (Table 4.11). Household characteristics, such as household size, number of adults

in the household, owing land and life events, also significantly affect parental health status (Table 4.12). Table 4.13 shows that households with high numbers of adults are 1 per cent less likely to visit outpatient care; life events in households make a positive contribution to parental health; and parents who smoke are 3.3 per cent more likely to visit outpatient care.

Table 4.14 presents estimation results regarding the impact of son migration on the incidence of parents taking medication for anemia, high blood pressure, diabetes or cholesterol. The pooled OLS, panel probit and FE method shows the negative impact of son migration on parental medication; however, only the pooled OLS and probit method showed a significant impact.

Overall, having at least one migrant son positively affected three parental health outcomes. Parents of migrant sons are more likely to have a better SRH status, fewer incidents of morbidity symptoms and fewer visits to outpatient compared to parents without child migrant. The economic transfers of son migration positively contribute to the health of parents left behind.

4.5.3 Daughter Migration and Parental Health Outcomes

In a study of family organisation, Mason (1992) highlighted that different systems of family organisation determined the arrangement of support to the elderly. Young women are expected to carry out the majority of domestic work, such as childcare, elder care, cooking, water collection and cleaning. In Indonesia, female household members are responsible for care of the elderly (Van Eeuwijk 2006). This section examines the potential differential impact of daughter migration on the health status of parents left behind

Tables 4.15 - 4.18 present estimation results of the impact of daughter migration on four parental health outcomes using pooled OLS, panel ordered probit or probit, and FE methods. The mean and standard deviation of parents with and without migrant children for daughter migration presented in table 4.33.The FE estimation shows that parents of migrant daughters increase their SRH status by 0.051 point or 9.9 per cent of the standard deviation. The parents of migrant daughters also have a better SRH status than the parents of migrant sons (Table 4.15). Parents with migrant daughters are 3.4 per cent less likely to have more than five unhealthy days (Table 4.17). Parental working status, BMI, household size and owning land significantly affect the number of unhealthy days reported by parents (Table 4.17). Employed parents tend to have more unhealthy days than unemployed parents, while parents with low BMIs have fewer unhealthy days. The bigger the household, the fewer unhealthy days; households that owned land for farming also had fewer unhealthy days.

Parental morbidity symptoms and use of medication are reported in Table 4.16 and Table 4.18. All the three estimation methods show that parents with migrant daughters are less likely to have morbidity symptoms (Table 4.16) and are also less likely to be on medication for anemia, high blood pressure, diabetes or cholesterol (Table 4.18); however, significant results were only found using the pooled OLS and panel probit methods.

Estimations of daughter migration on parental health outcomes show that having at least one migrant daughter positively affects two parental health outcomes. Parents of migrant daughters are more likely to have a better SRH status and fewer unhealthy days compared to parents without child migrant. In terms of international labour migration, the majority of Indonesian labour migrants are female, and they are mostly employed in Saudi Arabia and Malaysia as domestic workers (Kaur 2007; Piper 2008). Hugo (2000) and

Williams (2008) reported that remittances sent from Indonesian migrant women workers in Malaysia have increased since the early 1990s. Following on from this, this study finds that daughter migration contributes to a better health status for parents left behind. Daughter migration does not imply loss of care or support; instead, it provides economic transfers that improve the living standards of parents left behind such that they can afford to buy more nutritious foods and better access to health care services.

Frankenberg and Kuhn (2004) reported that both male and female migrants transfer a significant remittance. This study shows that both son and daughter migration positively contributes to the health status of parents left behind. Daughter migration positively contributes to two parental health outcomes while son migration positively contributes to three parental health outcomes. However, the lower number of female migrants in the sample could explain this result. As reported in Table 4.2, males comprise two-thirds and females comprise one-third of the migrant sample in this study.

4.5.4 Child Migration and Health Outcomes for Parents Aged 50+

Tables 4.19–4.21 present estimation results of the impact of child migration on the health outcomes of parents aged over 50 and table 4.34 present the descriptive statistics of mean and standard deviation. All three estimation methods consistently show that child migration has a positive effect on the health status of parents left behind. The FE estimation result shows that child migration positively affects two parental health outcomes. Parents aged 50+ with at least one child migrant are more likely to have a better SRH status and fewer episodes of morbidity symptoms than parents of non-migrant children.

Table 4.19 shows that adult child migration significantly increases the SRH status of parents aged 50+ by 0.03 point or 6.5 per cent of the standard deviation. Smoking

captures behavioural risk factors that may decrease health status and are expected to have a negative effect; however, in our estimation, smoking behaviour showed a positive and significant association with better health status. This positive effect of smoking behaviour on health status can be explained by the view that risky-health behaviours are influenced by socio-economic position and context, as indicated in Lynch et al. (1996) and Davey Smith, Hart & Hole (1998).

Table 4.20 shows that parents aged 50+ with at least one adult child migrant are 5.19 per cent less likely to experience morbidity symptoms. Table 4.21 shows the negative impact of child migration on the number of unhealthy days of parents aged 50+; however, only the pooled OLS and panel probit methods showed a significant result.

4.5.5 Child Migration and Health Outcomes When Parents Live in Rural Areas

Migration in Indonesia is characterised by rural–urban movement. Approximately two million people aged five and above, or 61 per cent of migrants, come from rural areas (Resosudarmo, Yamauchi & Effendi 2010). In 2015, approximately 62.7 per cent of poor peopled lived in rural areas. Equality in access to health services remains a challenge due to the disparity in health facilities, workforce and equipment between rural and urban areas. Malaria is endemic in rural and remote areas of Indonesia and, as reported in 2014 National Socio-Economic Survey, the number of health complaints is always higher in rural areas than in urban areas. For these reasons, it is important to observe the possible impact of child migration on the health of parents who live in rural areas.

Tables 4.22–4.25 present estimation results of the impact of child migration on the health outcomes of parents who live in rural areas. The mean and standard deviation of parents living in rural areas with and without migrant children presented in table 4.35. Parents who live in rural areas with at least one child migrant are more likely to have a

better SRH status; their SRH status increases by 0.047 point or 9.17 per cent of the standard deviation (Table 4.22). They are 4.6 per cent less likely to have episodes of morbidity symptoms (Table 4.23), and have fewer unhealthy days (Table 4.24). Parents who live in rural areas with at least one child migrant are less likely to visit outpatient care; however, a significant impact was only found using pooled OLS and panel probit methods (Table 4.25). Adult child migration positively contributes to health outcomes of parents who live in rural areas. Parents with at least one child migrant are more likely to have a better SRH status, fewer episodes of morbidity symptoms and fewer unhealthy days compared to parents without child migrant.

Overall this study finds that adult child migration positively affects the health status of parents left behind. The parents of adult child migrants who live in rural areas and the parents aged 50+ with adult child migrants have a better SRH status and fewer morbidity symptoms. Both son and daughter migration increases income and financial support and thus contributes to a better health status for the parents left behind. The positive contribution of adult children's migration on parents' health supports earlier findings for Indonesia using a counterfactual approach (Kuhn, Everett & Silvey 2011) and Bangladesh and Romania as reported in Kuhn (2005) and Böhme, Persian and Stöhr (2015), respectively.

4.5.6 Sensitivity Analysis

The FE model controls for specific variables that do not vary over time; however, time-varying unobserved factors could affect the estimation results. For this reason, I test the main results using IV estimation. The IV method requires the existence of one or more valid instrument. A valid instrument is one that is substantially correlated with the

endogenous regressors (i.e., migration), but is not correlated to the outcome (parental health) except through its effect on the endogenous regressor (migration).

The rate of community-level migration can be a valid instrument for a child's decision to migrate since it provides a network to migration. Relatives or friends in the destination provide information about jobs and cost, thus inducing more migration; however, this is not correlated to parental health status. Communities with high migration rates will tend to attract more household members to migrate. Several studies show the importance of the migration network to the decision to migrate (Rozelle, Taylor & de Brauw 1999; Taylor, Rozelle & de Brauw 2003; McCarthy et al. 2006).

Using migration at the community level as the IV, this study reports estimation results on all samples and sub-samples using the FE-IV method. The first stage regression in FE-IV estimations show that the instrument 'migration rate at community level' is always significant at less than 0.1 per cent; hence, it is both a valid instrument and informative, as it provides strong support for identification. A set of diagnostic tests are presented in each of the FE-IV estimation results. The F statistic on the excluded instruments, under-identification test, weak identification and endogeneity test are appended at each table of FE-IV estimation results (Tables 4.26–4.31). These tests show that all the conditions necessary for valid instruments are satisfied. First stage estimates of all FE-IV method are reported in table 4.36-4.40.

A higher migration rate at community level increases the likelihood of family members to migrate. However, the coefficients resulted from FE-IV estimations are higher than the FE method. The challenge in using the IV method lies in finding the valid instrument (Baum, Schaffer and Stillman 2003). Kimberlin and Winterstein (2008) highlighted that measurement approach is critical in both selection measures and

measurement of instrument. Validity requires that an instrument should also reliable. Further, evidence of reliability and validity should be well established.

The results are reported in Tables 4.26–4.31. Although the coefficient results in estimations using the FE-IV method are always higher than those generated using the FE method, FE-IV estimation results are consistent with pooled OLS, panel ordered probit/probit, and FE methods. Lang (1993) and Card (2001) stressed that estimations gained via the IV method could be higher than those generated by OLS because the IV method estimates approximate average effects among a small and peculiar group, while OLS approximates average effects among everyone (in the absence of omitted variables and measurement error biases). Imbens and Angrist (1994) suggested that, in a more realistic environment, different instruments should measure different effects such that the average treatment effect is LATE (local average treatment effect).

Parents with migrant children are more likely to have a better SRH status, fewer episodes of morbidity symptoms, fewer numbers of unhealthy days, fewer visits to outpatient care and are less likely to be on medication (Table 4.26.). Parents with migrant sons are more likely to have fewer episodes of morbidity symptoms and fewer visits to outpatient care (Table 4.27). Parents with migrant daughters are more likely to have a better SRH status and fewer episodes of morbidity symptoms (Table 4.28). Parents aged 50+ with at least one child migrant are more likely to have fewer episodes of morbidity symptoms and fewer unhealthy days (Table 4.29). Parents who live in rural areas and have at least one child migrant are more likely to have fewer unhealthy days and fewer episodes of morbidity symptoms (Table 4.30).

4.5.7 Transmission Mechanism

To identify possible channels through which migrant children can contribute to parental health, this study estimates the effects of adult child migration on several types of household expenditures. Economic transfers (remittances) may increase the standard of living of MSHs through several channels. For example, remittances support households on a daily basis (Hadi 1999; Kanaiaupuni & Donato 1999; Asis 2006; Frankenberg & Kuhn 2004) and during family crises, such as ill health. Further, adult child migrants may have a better understanding of health and, and given the ease of communication, be able to provide health-related information to parents left behind (Hadi 1999; Taylor 1999; Frank & Hummer 2002; Kanaiaupuni et al. 2005).

An adverse economic outcome of health shocks is the loss of income due to out-of-pocket health care expenditures. Gertler and Gruber (2002) showed that households in Indonesia lost 29 per cent of income due to moderate illness shocks, while severe illness shocks reduced almost 62 per cent of household income. Remittances can help households to smooth expenditure by providing economic transfers during health crises that act as a basic health insurance policy for families left behind.

Using a logarithm of monthly per capita expenditure as presented in Table 4.31, estimations using pooled OLS, FE and FE-IV show that households with at least one adult child migrant have a significantly higher per capita total expenditure. This shows the monetary impact of migration on household income, which transfers to better health outcomes for the family left behind. This study finds that the migration of adult children significantly increases the per capita expenditure of MSHs. Increases in per capita expenditure lead to increases in the purchase of preventive care, such as medical and

nutritional input, as well as better access to health care, which results in a better health status for parents left behind.

4.6 Conclusion

The out-migration of the younger generation is an important phenomenon in Indonesia. Increasing life expectancy coupled with limited access to social security, limited social services for the elderly and limited access to health care services, means that the positive and negative consequences of adult child out-migration on the health of parents left behind is important to investigate.

Using longitudinal observation of the parents of migrant children across four waves of IFLS data (1997–2014), this study investigates the effect of adult child migration on the health of parents left behind. It focuses on five indicators of parental health: SRH status, episodes of morbidity symptoms, unhealthy days, visits to outpatient care and being on medication.

The preferred method used in this study is the OLS-FE method. The FE method controls for specific characteristics of respondents that did not vary over time and had a constant effect on the outcome, such as traits, genetics and personality. All estimation results are consistent under FE method and results from pooled OLS and panel ordered probit or probit methods are also reported. Estimations of all children migration on five parental health outcomes show consistent results in sign, magnitude and significance across all three methods. Estimation on son migration shows that two out of four parental health outcomes show consistent estimation result across three different method and three out of four parental health outcomes significantly resulted by FE method. Estimation on

daughter migration shows that two out of four parental health outcomes show consistent estimation result across three different method and all parental health outcomes significantly reported by pooled OLS. Estimation on all child migration on health outcomes of parent age 50+ shows that two out of three parental health outcomes show consistent estimation result across three different method and all parental health outcomes significantly reported by pooled OLS. Estimation on all child migration on health outcomes of parent live in rural area shows that three out of four parental health outcomes show consistent estimation result across three different method and all parental health outcomes significantly reported by pooled OLS.

The parents of migrant children are more likely to have a better SRH status, fewer episodes of morbidity symptoms, fewer unhealthy days, fewer visits to outpatient care and are less likely to be on medication. Estimation on the sub-sample of migrant children—that is, the son and daughter groups—also showed consistent results. The parents of migrant children are likely to have a good SRH status, few episodes of morbidity symptoms, few unhealthy days, few visits to outpatient care and are unlikely to be on medication.

Estimation of the sub-sample of parents aged 50+ and parents who live in rural areas also reported a positive impact of adult child migration on parental health. Parents aged 50+ with at least one adult child migrant are more likely to have a better SRH status and fewer episodes of morbidity symptoms. Parents who live in rural areas and have at least one adult child migrant are also more likely to have a better SRH status, fewer episodes of morbidity symptoms and fewer unhealthy days.

Accommodating possible time-varying unobserved factors that could affect the estimation, this study uses the community-level migration rate as an instrument and

applies FE-IV estimations. The results are consistent with those gained using pooled OLS, panel ordered probit/probit, and FE methods. It is clear that the parents of migrant children are more likely to have better health than the parents of non-migrant children.

The analysis of transmission channels shows that migration reduces financial constraints and increases household's per capita total expenditure. Households with at least one migrant child are more likely to have a greater per capita total expenditure, which leads to better food consumption and better access to health care and preventive care (such as medical and nutritional input), resulting in a better health status for the parents left behind. Findings of a positive association between adult children's migration and the health status of parents left behind sheds light on the benefits of labour migration for health outcomes.

Table 4.6: All Adult Children's Migration and Parents' Self-Rated Health

	Pooled OLS	Ordered Probit			OLS Fixed Effect
		1 Unhealthy	2 Somewhat Healthy	3 Very Healthy	
Individual characteristics:					
Parent of migrant adult child	**0.0404*** **	**-0.0245*** **	**0.0094*** **	**0.0151*** **	**0.0455*** **
	(0.0094)	**(0.0060)**	**(0.0023)**	**(0.0037)**	**(0.0154)**
Age	-0.0047	0.0029	-0.0011	-0.0018	0.0009
	(0.0030)	(0.0019)	(0.0007)	(0.0011)	(0.0055)
Age squared	-0.00002	0.00001	-0.0000069	-.0000112	**-0.0001** **
	(0.000029)	(0.000017)	(0.000006)	.000011	**(0.00005)**
Education	0.0005	-0.0004	0.00016	0.00026	-0.0031
	(0.0010)	(0.0006)	(0.00026)	(0.00042)	(0.0030)
Working	0.0451	-0.0212	0.0081	0.0131	-0.0249
	(0.0419)	(0.0266)	(0.0102)	(0.0164)	(0.0538)
BMI	0.0009	-0.0006	0.0002	0.0003	**0.0094*** **
	(0.0009)	(0.00059)	(0.0002)	(0.00036)	**(0.0029)**
Smoking	**0.0570*** **	**-0.0352*** **	**0.0135*** **	**0.0217*** **	0.0142
	(0.0077)	**(0.0051)**	**(0.0020)**	**(0.0031)**	(0.0233)
Household (HH) characteristics:					
HH size	**-0.0115*** **	**0.0067*** **	**-0.0025*** **	**-0.0041*** **	0.0053
	(0.0021)	**(0.0013)**	**(0.0005)**	**(0.00084)**	(0.0048)
Number of adults	**0.0074** **	**-0.0043** **	**0.0016** **	**0.0026** **	0.0039
	(0.0033)	**(0.0021)**	**(0.0008)**	**(0.0012)**	(0.0051)
Log HH asset	**0.0085*** **	**-0.0046*** **	**0.0017*** **	**0.0028*** **	-0.0028
	(0.0023)	**(0.0014)**	**(0.0005)**	**(0.0008)**	(0.0046)
Land	0.0087	-0.0042	0.0016	0.0026	-0.0064
	(0.0076)	(0.0051)	(0.0019)	(0.0031)	(0.0159)
Non-farm family business	-0.0022	0.0017	-0.0006	-0.0010	-0.0018
	(0.0073)	(0.0045)	(0.0017)	(0.0028)	(0.0124)
Life events	**-0.0178** **	0.0089	-0.0034	-0.0055	-0.0089
	(0.0084)	(0.0057)	(0.0022)	(0.0035)	(0.0122)
N	21,491		21,491		21,491
Prob > F	0.0000		0.0000		0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health is a general condition of health in which respondents are asked to rate their current health condition. After reordering and revision the three response categories are: 1 = somewhat unhealthy & unhealthy; 2 = somewhat healthy; 3 = very healthy.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.7: All Adult Children's Migration and Parents' Morbidity

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0266*** **	**-0.0278*** **	**-0.0290*** **
	(0.0063)	**(0.0071)**	**(0.01093)**
Age	-0.00032	0.00035	0.0037
	(0.00217)	(0.00199)	(0.0042)
Age squared	0.000012	0.0000063	-0.000023
	(0.00002)	(0.00001)	(0.00004)
Education	**-0.0022*** **	**-0.0021*** **	-0.00095
	(0.00071)	**(0.00071)**	(0.0030)
Working	-0.0087	-0.00216	**0.0878***
	(0.0346)	(0.0299)	**(0.0539)**
BMI	-0.0004	-0.0003	-0.0006
	(0.0006)	(0.0006)	(0.0019)
Smoking	**-0.0128** **	**-0.0131** **	-0.0158
	(0.0053)	**(0.0055)**	(0.0184)
Household (HH) characteristics:			
HH size	-0.0019	**-0.0032** **	**-0.0302*** **
	(0.0013)	**(0.0014)**	**(0.0032)**
Number of adults	0.0034	**0.0042***	**0.0137*** **
	(0.0022)	**(0.0022)**	**(0.0040)**
Log HH assets	-0.0004	-0.0001	0.0022
	(0.0017)	(0.0016)	(0.0038)
Land	**-0.0208*** **	**-0.0222*** **	**-0.0250** **
	(0.0052)	**(0.0056)**	**(0.01197)**
Non-farm family business	0.0023	0.0028	0.0013
	(0.0049)	(0.0049)	(0.0098)
Life events	**0.0519*** **	**0.0463*** **	**0.0486*** **
	(0.0079)	**(0.0064)**	**(0.0120)**
N	16,748	16,748	16,748
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Morbidity assesses whether parents have any symptoms of acute morbidity during the past four weeks: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.8: All Adult Children's Migration and Parents' Visits to Outpatient Care

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0130****	**-0.0133****	**-0.01800***
	(0.0064)	**(0.0069)**	**(0.01063)**
Age	-0.0011	-0.00076	0.0023
	(0.00207)	(0.0020)	(0.0039)
Age squared	0.00002	0.000019	0.00001
	(0.00001)	(0.000018)	(0.00003)
Education	**0.0013***	0.0011	0.0028
	(0.0007)	(0.00073)	(0.0023)
Working	**-0.0722****	**-0.0576****	-0.01670
	(0.0344)	**(0.0262)**	(0.0358)
BMI	**0.0027*****	**0.0025*****	0.0010
	(0.00067)	**(0.0006)**	(0.00207)
Smoking	**-0.0553*****	**-0.0571*****	0.01877
	(0.0051)	**(0.0059)**	(0.0144)
Household (HH) characteristics:			
HH size	0.000017	-0.00046	**-0.0061***
	(0.00149)	(0.00151)	**(0.0033)**
Number of adults	**-0.00526****	-0.0050**	-0.0060
	(0.0022)	(0.0023)	(0.0038)
Log HH assets	**0.00696*****	0.0066***	0.00190
	(0.0015)	(0.0016)	(0.0033)
Land	**-0.0124****	-0.0122**	0.0019
	(0.0054)	(0.0057)	(0.0112)
Non-farm family business	**0.0021**	0.00364	**0.0156***
	(0.0050)	(0.0050619)	**(0.0093)**
Life events	**0.0378*****	0.0349***	**0.0254*****
	(0.0065)	(0.0061)	**(0.0092)**
N	22,994	22,994	22,994
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Outpatient care is defined as having visited a public hospital, puskesmas, private hospital, health worker or doctor's practice or been visited by a health worker or doctor in the last four weeks. The response are: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.9: All Adult Children's Migration and Parents' Unhealthy Days

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0118****	**-0.0114****	**-0.0162***
	(0.0057)	**(0.00596)**	**(0.0095)**
Age	0.0019	0.00347**	**0.0081****
	(0.0020)	(0.0017)	**(0.0036)**
Age squared	0.000003	-0.00001	-0.00001
	(0.000019)	(0.000016)	(0.00003)
Education	**-0.0023*****	**-0.0022*****	0.0011
	(0.0006)	**(0.0006)**	(0.0020)
Working	-0.0400	-0.0275	0.0466
	(0.0303)	(0.0227)	(0.0451)
BMI	-0.04009	-0.00058	**-0.0052*****
	(0.03037)	(0.00055)	**(0.0018)**
Smoking	**-0.0304*****	**-0.03105*****	**-0.0298****
	(0.0046)	**(0.00502)**	**(0.0143)**
Household (HH) characteristics:			
HH size	0.0022*	0.0017	**-0.0085*****
	(0.0013)	(0.0012)	**(0.003)**
Number of adults	-0.0030	-0.0024	0.0037
	(0.0020)	(0.0020)	(0.0034)
Log of HH assets	**0.0053*****	**0.0055*****	0.0027
	(0.0014)	**(0.0014)**	(0.0032)
Land	**-0.0226*****	**-0.0221*****	-0.0037
	(0.0046)	**(0.0049)**	(0.0102)
Non-farm family business	0.0037	0.0038	0.0022
	(0.0044)	(0.0044)	(0.0082)
Life events	**0.0121****	**0.01088****	**0.1395***
	(0.0055)	**(0.0055)**	**(0.0084)**
N	21,473	21,473	21,473
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Unhealthy days are the number of days missed due to poor health. The response are: 1 = had more than 5 unhealthy days in the last 4 weeks; 0 = had less than 5 unhealthy days in the last four weeks.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.10: All Adult Children's Migration and Parents' Medication

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0147*** **	**-0.0138*** **	**-0.0156** **
	(0.0039)	**(0.0041)**	**(0.0074)**
Age	0.0023	**0.0033*** **	0.0050
	(0.0014)	**(0.0010)**	(0.0033)
Age squared	0.0000019	-0.000013	0.00002
	(0.000014)	(0.000009)	(0.00003)
Education	**0.0028*** **	0.0018	-0.0031
	(0.00051)	(0.0003)	(0.0022)
Working	0.011	0.0080	-0.0251
	(0.0209)	(0.0184)	(0.0464)
BMI	**0.0037*** **	**0.0025*** **	-0.0016
	(0.0004)	**(0.0002)**	(0.0017)
Smoking	**-0.0256*** **	**-0.0214*** **	**-0.0354*** **
	(0.0032)	**(0.0032)**	**(0.0139)**
Household (HH) characteristics:			
HH size	**-0.0018***	**-0.0016** **	**-0.0087*** **
	(0.0009)	**(0.0008)**	**(0.0025)**
Number of adults	0.0012	0.0010	0.0014
	(0.0016)	(0.0012)	(0.0029)
Log of HH assets	**0.0095*** **	**0.0079*** **	-0.0021
	(0.0012)	**(0.00094)**	(0.0024)
Land	**-0.0186*** **	**-0.0168*** **	0.0035
	(0.0032)	**(0.0032)**	(0.0084)
Non-farm family business	-0.0025	-0.00003	-0.0014
	(0.0034)	(0.0026)	(0.0069)
Life events	0.0017	-0.0010	0.0088
	(0.0042)	(0.0042)	(0.0084)
N	16,797	16,797	16,797
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 1% level. ** Significant at 5% level. *** Significant at 1% level.
On medication is taking medicine for anemia, high blood pressure, diabetes or cholesterol. The response is: 1 = yes; 0 = no.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.11: Son Migration and Parents' Self-Rated Health

	Pooled OLS	Ordered probit			OLS Fixed effect
		1 Unhealthy	2 Somewhat healthy	3 Very healthy	
Individual characteristics:					
Parent of migrant adult child	**0.0323*** **	**-0.0193*** **	**0.0078*** **	**0.0115*** **	**0.0352***
	(0.0112)	**(0.0073)**	**(0.0029)**	**(0.0043)**	**(0.0197)**
Age	-0.0036	0.0024	-0.0009	-0.0014	-0.0028
	(0.0037)	(0.0023)	(0.00094)	(0.0013)	(0.0071)
Age squared	-0.00003	0.00002	-0.000009	-0.000014	-0.00009
	(0.000034)	(0.00002)	0.000008	(0.000013)	(0.00006)
Education	-0.0014	0.0009	-0.0003	-0.00055	-0.0037
	(0.0012)	(0.0008)	(0.00033)	(0.00049)	(0.00371)
Working	**0.0493***	**-0.0278***	**0.0112***	**0.0165***	-0.0329
	(0.0279)	**(0.0170)**	**(0.0069)**	**(0.0101)**	(0.0408)
BMI	0.0007	-0.0006	0.0002	0.0003	**0.0130*** **
	(0.0011)	(0.0007)	(0.00028)	(0.0004)	**(0.0037)**
Smoking	**0.0569*** **	**-0.0352**	**0.0142*** **	**0.0210*** **	0.0149
	(0.0091)	**(0.0061)**	**(0.0025)**	**(0.0036)**	(0.0287)
Household (HH) characteristics:					
HH size	**-0.0122*** **	**0.0071*** **	**-0.0029*** **	**-0.0042*** **	0.0020
	(0.0025)	**(0.0016)**	**(0.0006)**	**(0.0009)**	(0.0060)
Number of adults	**0.0084** **	**-0.0048***	**0.0019***	**0.0028***	0.0046
	(0.0039)	**(0.0024)**	**(0.0010)**	**(0.0014)**	(0.0063)
Log of HH assets	**0.0105*** **	**-0.0059*** **	**0.0023*** **	**0.0035*** **	-0.0014
	(0.0027)	**(0.0017)**	**(0.0007)**	**(0.0010)**	(0.0055)
Land	0.0175**	-0.0092	0.0037	0.0054	-0.0207
	(0.0091)	(0.0060)	(0.0024)	(0.0036)	(0.0198)
Non-farm family business	0.0078	-0.0049	0.00201	0.0029	0.0120
	(0.0086)	(0.0055)	(0.0022)	(0.0032)	(0.0152)
Life events	**-0.0234** **	**0.0127***	**-0.0051***	**-0.0076***	-0.0099
	(0.0098)	**(0.0067)**	**(0.0027)**	**(0.004)**	(0.0146)
N	15,311		15,311		15,311
Prob > F	0.0000		0.0000		0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health is a general condition of health in which respondents are asked to rate their current health condition. After reordering and revision the three response categories are: 1 = somewhat unhealthy & unhealthy; 2 = somewhat healthy; 3 = very healthy.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.12: Son Migration and Parents' Morbidity

	Pooled OLS	Probit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0234*** **	**-0.0241*** **	**-0.0238***
	(0.007)	**(0.0083)**	**(0.0137)**
Age	0.0026	0.0027	0.0012
	(0.0025)	(0.0024)	(0.0053)
Age squared	-0.00001	-0.00001	-0.000009
	(0.00002)	(0.00002)	(0.00005)
Education	**-0.0015***	**-0.0014***	-0.0005
	(0.0008)	**(0.0008)**	(0.0037)
Working	-0.0117	-0.0109	0.0163
	(0.0207)	(0.018)	(0.0347)
BMI	0.0003	0.0003	0.0012
	(0.0007)	(0.0007)	(0.0026)
Smoking	**-0.0138****	**-0.0142****	-0.0156
	(0.0062)	**(0.0064)**	(0.0229)
Household (HH) characteristics:			
HH size	-0.0021	**-0.0031***	**-0.0311*****
	(0.0016)	**(0.0017)**	**(0.0040)**
Number of adults	0.0021	0.0029	**0.0132*****
	(0.0026)	(0.0026)	**(0.0051)**
Log of HH assets	-0.0029	-0.0026	0.0005
	(0.0020)	(0.0019)	(0.004)
Land	**-0.0266*****	**-0.0275*****	**-0.0245***
	(0.006)	**(0.0065)**	**(0.0148)**
Non-farm family business	0.0051	0.0057	0.0047
	(0.0057)	(0.0057)	(0.0119)
Life events	**0.0449*****	**0.0409*****	**0.0425*****
	(0.009)	**(0.0075)**	**(0.0144)**
N	11,879	11,879	11,879
Prob > F	0.0000	0.0000	

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Morbidity assesses whether parents have had any symptoms of acute morbidity during the past four weeks: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.13: Son Migration and Parents' Visits to Outpatient Care

	Pooled OLS	Probit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	-0.0093	**-0.0098**	**-0.0227***
	(0.0077)	**(0.0082)**	**(0.0136)**
Age	0.0014	**0.0017**	**0.0015**
	(0.0024)	**(0.0025)**	**(0.0049)**
Age squared	0.000001	0.000009	0.00001
	(0.00002)	(0.00002)	(0.00004)
Education	**0.0018****	**0.0016***	0.0032
	(0.0008)	**(0.0008)**	(0.0029)
Working	**0.02934***	**0.0279***	0.0134
	(0.01556)	**(0.0162)**	(0.0251)
BMI	**0.0029*****	**0.0028*****	0.0017
	(0.0008)	**(0.0007)**	(0.0026)
Smoking	**-0.0558*****	**-0.0563*****	**0.0336****
	(0.0062)	**(0.0070)**	**(0.0172)**
Household (HH) characteristics:			
HH size	0.00061	0.0004	-0.0016
	(0.0017)	(0.0017)	(0.0040)
Number of adults	**-0.0073*****	**-0.0075*****	**-0.0103****
	(0.0026)	**(0.0026)**	**(0.0046)**
Log of HH assets	**0.0063*****	**0.0058*****	0.0034
	(0.0018)	**(0.0019)**	(0.0039)
Land	**-0.0170*****	**-0.0174*****	-0.0021
	(0.0063)	**(0.0067)**	(0.0140)
Non-farm family business	0.0011	0.00208	0.0067
	(0.0059)	(0.0059)	(0.0112)
Life events	0.0431	**0.0402*****	**0.0272****
	(0.0076)	**(0.0071)**	**(0.0111)**
N	16,329	16,329	16,329
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Outpatient care is defined as visiting a public hospital, puskesmas, private hospital, clinic, health worker or doctor's practice or having been visited by a health worker or doctor in the last four weeks. The response are: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.14: Son Migration and Parents' Medication

	Pooled OLS	Probit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0152*** **	**-0.0138*** **	-0.0088
	(0.0046)	**(0.0049)**	(0.0097)
Age	0.0016	**0.0024***	0.00019
	(0.0017)	**(0.0013)**	(0.0042)
Age squared	0.000007	-0.000005	**0.00006***
	(0.00001)	(0.00001)	**(0.00003)**
Education	**0.0031*** **	**0.0020*** **	-0.0009
	(0.0006)	**(0.0004)**	(0.0026)
Working	-0.0021	-0.00009	0.0015
	(0.0144)	(0.0097)	(0.0255)
BMI	**0.0037*** **	**0.0025*** **	-0.0019
	(0.0005)	**(0.0003)**	(0.0022)
Smoking	**-0.0259*** **	**-0.022*** **	-0.0178
	(0.0038)	**(0.0038)**	(0.0171)
Household (HH) characteristics:			
HH size	-0.0011	-0.0009	**-0.0070****
	(0.0011)	(0.0009)	**(0.0031)**
Number of adults	0.0010	0.0009	0.0014
	(0.0018)	(0.0014)	(0.0036)
Log of HH assets	**0.0100*** **	**0.0083*** **	0.00036
	(0.0014)	**(0.0011)**	(0.0032)
Land	**-0.0182*** **	**-0.0164*** **	-0.0061
	(0.0038)	**(0.0038)**	(0.0105)
Non-farm family business	-0.0020	0.00015	-0.0099
	(0.0040)	(0.0030)	(0.0087)
Life events	0.0042	0.0014403	0.0077
	(0.0051)	(0.0048)	(0.0101)
N	11,909	11,909	11,909
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
On medication is defined as taking medicine for anemia, high blood pressure, diabetes or cholesterol. The response are: 1 = yes; 0 = no.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.15: Daughter Migration and Parents' Self-Rated Health

	Pooled OLS	Ordered probit			OLS Fixed effect
		1 Unhealthy	2 Somewhat healthy	3 Very healthy	
Individual characteristics:					
Parent of migrant adult child	**0.0554*** **	**-0.0335*** **	**0.0124*** **	**0.0211*** **	**0.0511***
	(0.0149)	**(0.0095)**	**(0.0036)**	**(0.0060)**	**(0.0269)**
Age	-0.0045	0.0024	-0.0009	-0.0015	0.0052
	(0.00456)	(0.0027)	(0.0010)	(0.0017)	(0.0090)
Age squared	-0.0000249	0.00001	-0.000007	-0.000007	**-0.00015***
	(0.000043)	(0.00002)	(0.000009)	(0.000009)	**(0.00008)**
Education	**0.0034** **	**-0.0021** **	**0.0007** **	**0.0013** **	-0.00089
	(0.0014)	**(0.0009)**	**(0.0003)**	**(0.0005)**	(0.0046)
Working	0.0257	-0.0148	0.0054	0.0093	0.01501
	(0.0307)	(0.0183)	(0.0068)	(0.0115)	(0.0517)
BMI	0.00114	-0.0005	0.0002	0.0003	**0.0099** **
	(0.0013)	(0.0007)	(0.0002)	(0.0004)	**(0.0046)**
Smoking	**0.0547*** **	**-0.0323*** **	**0.0119*** **	**0.0204*** **	-0.0061
	(0.0107)	**(0.0069)**	**(0.0026)**	**(0.0044)**	(0.0363)
Household (HH) characteristics:					
HH size	**-0.0111*** **	**0.0067*** **	**-0.0024*** **	**-0.0042*** **	**0.0175** **
	(0.0029)	**(0.0018)**	**(0.00069)**	**(0.0011)**	**(0.0073)**
Number of adults	**0.0113** **	**-0.0069** **	**0.0025** **	**0.0043** **	0.0121
	(0.0045)	**(0.0027)**	**(0.0010)**	**(0.0017)**	(0.0078)
Log of HH assets	0.0035	-0.0021	0.0007	0.0013	-0.0057
	(0.0032)	(0.0019)	(0.0007)	(0.0012)	(0.0075)
Land	-0.0110	0.0060	-0.0022	-0.0038	0.0135
	(0.0107)	(0.0069)	(0.0025)	(0.0044)	(0.0258)
Non-farm family business	-0.0095	0.0048	-0.0017	-0.0030	0.0178
	(0.010)	(0.0062)	(0.0023)	(0.0039)	(0.0194)
Life events	-0.0133	0.0066	-0.0024	-0.0041	0.0039
	(0.0118)	(0.0077)	(0.0028)	(0.0048)	(0.0189)
N	11,104		11,104		11,104
Prob > F	0.0000		0.0000		0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health is a general condition of health in which respondents are asked to rate their current health condition. After reordering and revision, the three response categories are: 1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.16. Daughter Migration and Parents' Morbidity

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0194***	**-0.0193***	-0.0156
	(0.0104)	**(0.0115)**	(0.0231)
Age	-0.0053	-0.0043	-0.0028
	(0.0034)	(0.0029)	(0.0071)
Age squared	0.00005*	0.00004*	0.00003
	(0.00003)	(0.00002)	(0.00006)
Education	**-0.0025*****	**-0.0024****	0.0047
	(0.00098)	**(0.00098)**	(0.0055)
Working	0.0068	0.0096	0.0485
	(0.0225)	(0.0224)	(0.0416)
BMI	-0.00051	-0.0004	0.00031
	(0.00085)	(0.0008)	(0.0029)
Smoking	-0.0076	-0.0075	-0.0062
	(0.0074)	(0.0078)	(0.0313)
Household (HH) characteristics:			
HH size	-0.00100	-0.0018	**-0.0327*****
	(0.0019)	(0.0020)	**(0.0053)**
Number of adults	0.0027	0.00317	**0.01475****
	(0.0031)	(0.00311)	**(0.0065)**
Log of HH assets	**0.00409***	**0.0041***	0.00720
	(0.0024)	**(0.0023)**	(0.0065)
Land	**-0.01711****	**-0.0178****	-0.0143
	(0.0075)	**(0.0078)**	(0.0216)
Non-farm family business	-0.0030	-0.0034	-0.0160
	(0.0069)	(0.0069)	(0.0166)
Life events	**0.0630*****	**0.0561*****	**0.0643*****
	(0.0112)	**(0.0088)**	**(0.0198)**
N	8,432	8,432	8,432
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Morbidity assesses whether parents have had any symptoms of acute morbidity during the past four weeks: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.17: Daughter Migration and Parents' Unhealthy Days

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0269*** **	**-0.0281*** **	**-0.03416** **
	(0.0086)	**(0.0098)**	**(0.01744)**
Age	0.0029	**0.0041***	0.0024
	(0.00294)	**(0.0025)**	(0.0058)
Age squared	0.000004	-0.000017	0.00005
	(0.00002)	(0.00002)	(0.000055)
Education	**-0.0018** **	**-0.0017** **	0.00143
	(0.0008)	**(0.0008)**	(0.0032)
Working	-0.0207	-0.0150	**0.0712** **
	(0.0206)	(0.0163)	**(0.0299)**
BMI	-0.0006	-0.0006	**-0.0063** **
	(0.0007)	(0.0007)	**(0.0027)**
Smoking	**-0.0355*** **	**-0.0363*** **	-0.0153
	(0.0063)	**(0.0068)**	(0.0206)
Household (HH) characteristics:			
HH size	0.0013	0.0011	**-0.0092***
	(0.0017)	(0.0017)	**(0.0051)**
Number of adults	-0.0034	-0.0031	-0.0002
	(0.0027)	(0.0026)	(0.0050)
Log of HH assets	0.0032	**0.0033***	0.0025
	(0.0020)	**(0.0019)**	(0.0052)
Land	**-0.0196*** **	**-0.0203*** **	**-0.0326** **
	(0.0064)	**(0.0068)**	**(0.0158)**
Non-farm family business	0.0033	0.0024	-0.0048
	(0.0060)	(0.0060)	(0.0131)
Life events	0.0039	0.0037	0.0206
	(0.0073)	(0.0075)	(0.0128)
N	11,096	11,096	11,096
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Unhealthy days are the number of days missed due to poor health. The response are: 1 = had more than 5 unhealthy days in the last 4 weeks; 0 = had less than 5 unhealthy days in the last four weeks.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.18: Daughter Migration and Parents' Medication

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0124****	**-0.0140****	-0.0145
	(0.0059)	**(0.0067)**	(0.0146)
Age	0.0032	**0.0045*****	**0.0125****
	(0.0021)	**(0.0015)**	**(0.0056)**
Age squared	-0.000004	-0.00002*	-0.00004
	(0.00002)	(0.00001)	(0.00005)
Education	**0.0023*****	**0.0014*****	**-0.0069****
	(0.0006)	**(0.0004)**	**(0.0034)**
Working	-0.0054	-0.0019	0.0585*
	(0.0179)	(0.0094)	(0.0337)
BMI	**0.0038*****	**0.0024*****	-0.00064
	(0.00063)	**(0.00039)**	(0.00281)
Smoking	**-0.0269*****	**-0.0221*****	**-0.0774*****
	(0.0044)	**(0.0044)**	**(0.0238)**
Household (HH) characteristics:			
HH size	**-0.0025****	**-0.0021****	**-0.01097****
	(0.0012)	**(0.0010)**	**(0.0044)**
Number of adults	0.00002	0.000152	0.0020
	(0.0020)	(0.00159)	(0.0047)
Log of HH assets	**0.0094*****	**0.0077*****	-0.0015
	(0.0016)	**(0.0012)**	(0.0039)
Land	**-0.0189*****	**-0.0171*****	0.0088
	(0.0044)	**(0.0044)**	(0.0163)
Non-farm family business	-0.0046	-0.0016	0.0087
	(0.00469)	(0.0035)	(0.0125)
Life events	0.0006	-0.0015	0.0105
	(0.0055)	(0.0057)	(0.0147)
N	8,468	8,468	8,468
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Being on medication is defined as taking medicine for anemia, high blood pressure, diabetes or cholesterol. The response is 1 = yes; 0 = no.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.19: Child Migration and Self-Rated Health of Parents Aged 50+

	Pooled OLS	Ordered probit			OLS Fixed effect
		1 Unhealthy	2 Somewhat healthy	3 Very healthy	
Individual characteristics:					
Parent of migrant adult child	**0.02671*** **	**-0.0186*** **	**0.0104*** **	**0.0081*** **	**0.0335***
	(0.0101)	**(0.0073)**	**(0.0041)**	**(0.0032)**	**(0.0179)**
Age	**-0.0124***	**0.0094** **	**-0.00528** **	**-0.0041** **	-0.0021
	(0.0067)	**(0.0045)**	**(0.0025)**	**(0.0020)**	(0.0104)
Age squared	0.00003	-0.00002	0.000014	0.00001	-0.00009
	(0.00005)	(0.00003)	(0.000019)	(0.000015)	(0.00008)
Education	0.0013	-0.0010	0.00059	0.0004	0.0025
	(0.0012)	(0.00093)	(0.00052)	(0.00041)	(0.0037)
Working	**0.0410***	-0.0225	0.0126	0.0099	-0.0172
	(0.0228)	(0.0157)	(0.0088)	(0.0069)	(0.0323)
BMI	-0.00003	-0.00002	0.000011	0.000009	0.0057
	(0.0012)	(0.00086)	(0.00048)	(0.00038)	(0.0037)
Smoking	**0.0615*** **	**-0.0441*** **	**0.0247*** **	**0.0194*** **	**0.0577** **
	(0.0097)	**(0.0073)**	**(0.0041)**	**(0.0032)**	**(0.0262)**
Household (HH) characteristics:					
HH size	**-0.0065*** **	**0.0044** **	**-0.0024** **	**-0.0019** **	-0.0008
	(0.0025)	**(0.0017)**	**(0.0010)**	**(0.00079)**	(0.0049)
Number of adults	0.0007	-0.00066	0.00037	0.00029	-0.0010
	(0.0040)	(0.0028)	(0.0015)	(0.0012)	(0.0062)
Log of HH assets	**0.0085*** **	**-0.00491** **	**0.0027** **	**0.0021** **	-0.0039
	(0.00302)	**(0.0021)**	**(0.0011)**	**(0.0009)**	(0.0057)
Land	0.0139	-0.0095	0.00535	0.0042	0.0029
	(0.0098)	(0.0072)	(0.0040)	(0.0031)	(0.0197)
Non-farm family business	0.00011	-0.0008	0.00045	0.0003	0.0149
	(0.0096)	(0.0067)	(0.0038)	(0.0029)	(0.0170)
Life events	-0.0077	0.0030	-0.0017	-0.0013	0.01034
	(0.0111)	(0.0085)	(0.0048)	(0.0037)	(0.0163)
N	13,825		13,825		13,825
Prob > F	0.0000		0.0000		0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level
Self-rated health is a general condition of health in which respondents are asked to rate their current health condition. After reordering and revision the three response categories are: 1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.20: Child Migration and Morbidity of Parent Aged 50+

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.02400*** **	**-0.02487*** **	**-0.0519*** **
	(0.0067)	**(0.0072)**	**(0.0137)**
Age	0.0021	0.0044	**0.01294***
	(0.0046)	(0.0044)	**(0.0078)**
Age squared	-0.00001	-0.00002	-0.00008
	(0.00003)	(0.00003)	(0.00006)
Education	**-0.00306*** **	**-0.0029*** **	**0.0064** **
	(0.0008)	**(0.0008)**	**(0.0033)**
Working	-0.01197	-0.0134	0.0056
	(0.01728)	(0.0153)	(0.0278)
BMI	-0.00027	-0.0003	-0.0015
	(0.00084)	(0.0008)	(0.0028)
Smoking	**-0.0232*** **	-0.0237	-0.02578
	(0.0066)	(0.0070)	(0.0202)
Household (HH) characteristics:			
HH size	**-0.0061*** **	**-0.00795*** **	**-0.0266*** **
	(0.0015)	**(0.00177)**	**(0.0033)**
Number of adults	**0.0079*** **	**0.0095*** **	**0.01582*** **
	(0.0026)	**(0.00278)**	**(0.0051)**
Log of HH assets	**-0.0067*** **	**-0.0060*** **	0.0010
	(0.0022)	**(0.0021)**	(0.0049)
Land	**-0.0230*** **	**-0.0251*** **	**-0.0453*** **
	(0.0066)	**(0.0071)**	**(0.0144)**
Non-farm family business	0.0061	0.0065	0.0128
	(0.0064)	(0.0064)	(0.0121)
Life events	0.0398***	**0.03773*** **	**0.04538*** **
	(0.0102)	**(0.0088)**	**(0.0153)**
N	11,051	11,051	11,051
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Morbidity assesses whether parents have had any symptoms of acute morbidity during the past four weeks: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.21: Child Migration and Unhealthy Days of Parents Aged 50+

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0166*** **	**-0.0165** **	**-0.0141**
	(0.0064)	**(0.0067)**	**(0.0123)**
Age	-0.0078	-0.0032	-0.0063
	(0.0048)	(0.0038)	(0.0076)
Age squared	**0.00008** **	0.00004	**0.0001** *
	(0.00003)	(0.00002)	**(0.00006)**
Education	**-0.0016** **	**-0.0016** **	0.0008
	(0.0008)	**(0.0008)**	(0.0025)
Working	0.00005	0.00077	0.0231
	(0.0149)	(0.0140)	(0.0240)
BMI	-0.0007	-0.00078	**-0.0056** **
	(0.0008)	(0.00076)	**(0.0027)**
Smoking	**-0.0462*** **	**-0.0491*** **	**-0.0547*** **
	(0.0061)	**(0.0067)**	**(0.0174)**
Household (HH) characteristics:			
HH size	0.0017	0.0014	**-0.00707** **
	(0.0016)	(0.0016)	**(0.00350)**
Number of adults	-0.0009	-0.00079	0.00359
	(0.0026)	(0.0025)	(0.0047)
Log of HH assets	**0.0064*** **	**0.0066*** **	**0.0071** *
	(0.0019)	**(0.0019)**	**(0.0042)**
Land	**-0.0211*** **	**-0.02155*** **	-0.01286
	(0.0063)	**(0.0066)**	(0.01376)
Non-farm family business	0.0037	0.00349	-0.0092
	(0.0061)	(0.0061)	(0.0115)
Life events	0.0042	0.0019	-0.00901
	(0.0077)	(0.0080)	(0.01191)
N	13,792	13,792	13,792
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Unhealthy days are the number of days missed due to poor health. The response are: 1 = had more than 5 unhealthy days in the last 4 weeks; 0= had less than 5 unhealthy days in the last four weeks.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.22: Child Migration and Self-Rated Health of Parents in Rural Areas

	Pooled OLS	Ordered probit			OLS Fixed effect
		1 Unhealthy	2 Somewhat healthy	3 Very healthy	
Individual characteristics:					
Parent of migrant adult child	**0.0366*** (0.0122)**	**-0.0229*** (0.0078)**	**0.0089*** (0.0030)**	**0.0140*** (0.0047)**	**0.0477** (0.0208)**
Age	-0.0049 (0.0042)	0.0033 (0.0025)	-0.0012 (0.0010)	-0.0020 (0.00156)	-0.0014 (0.0080)
Age squared	-0.00002 (0.00004)	0.00001 (0.00002)	-0.000005 (0.000009)	-0.000009 (0.00001)	-0.0001 (0.00007)
Education	**-0.0005*** (0.00162)**	**0.0033*** (0.0010)**	**-0.0013*** (0.0004)**	**-0.0020*** (0.0006)**	-0.0044 (0.00463)
Working	**0.0831** (0.0367)**	**-0.04954** (0.02038)**	**0.01929** (0.0080)**	**0.03024** (0.0124)**	0.02475 (0.04745)
BMI	**0.0831** (0.0367)**	**-0.0021** (0.00091)**	**0.0008** (0.0003)**	**0.0013** (0.0005)**	**0.0113** (0.0050)**
Smoking	**0.0469*** (0.0109)**	**-0.0298*** (0.0072)**	**0.0116*** (0.0029)**	**0.01824*** (0.0044)**	0.0010 (0.03361)
Household (HH) characteristics:					
HH size	**-0.0122*** (0.0031)**	**0.00704*** (0.0019)**	**-0.0027*** (0.00079)**	**-0.0043*** (0.0012)**	0.0057 (0.0076)
Number of adults	0.0040 (0.0051)	-0.0020*** (0.0032)	0.0008*** (0.0012)	0.0012 (0.0019)	-0.0074 (0.0081)
Log of HH assets	**0.0087** (0.0036)**	**-0.0047** (0.0022)**	**0.0018** (0.0008)**	**0.0028** (0.0013)**	0.00314 (0.0075)
Land	0.0042 (0.0106)	-0.00043 (0.0067)	0.00017 (0.0026)	0.00026 (0.0040)	-0.0249 (0.0213)
Non-farm family business	0.0067 (0.0108)	-0.0049 (0.0068)	0.0019 (0.0026)	0.0030 (0.0041)	0.02072 (0.0194)
Life events	**-0.0268** (0.0117)**	**0.01499* (0.0080)**	**-0.0058* (0.0031)**	**-0.0091* (0.0049)**	-0.0150 (0.01841)
N	10,078		10,078		10,078
Prob > F	0.0000		0.0000		0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health is a general condition of health in which respondents are asked to rate their current health condition. After reordering and revision the three response categories are: 1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.23: Child Migration and Morbidity of Parents in Rural Areas

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0313*** **	**-0.0330*** **	**-0.0464*** **
	(0.0082)	**(0.0090)**	**(0.0145)**
Age	-0.0005	0.00067	0.0077
	(0.0030)	(0.0026)	(0.0062)
Age squared	0.00001	0.000008	-0.00004
	(0.00002)	(0.00002)	(0.00005)
Education	-0.0011	-0.0012	-0.0060
	(0.0011)	(0.0011)	(0.0048)
Working	-0.02069	-0.0181	0.0195
	(0.02661)	(0.0216)	(0.0438)
BMI	-0.0013	-0.0013	**-0.0059***
	(0.0009)	(0.0009)	**(0.0032)**
Smoking	-0.0094	-0.0101	-0.0431
	(0.0077)	(0.0077)	(0.0281)
Household (HH) characteristics:			
HH size	-0.0014	-0.0024	**-0.0285*** **
	(0.0020)	(0.0021)	**(0.00541)**
Number of adults	0.0028	0.0032	0.0101
	(0.0035)	(0.0034)	(0.0065)
Log of HH assets	-0.0017	-0.0011	-0.0023
	(0.0027)	(0.0025)	(0.0067)
Land	**-0.0241*** **	**-0.0258*** **	**-0.0302***
	(0.0072)	**(0.0072)**	**(0.0164)**
Non-farm family business	0.0059	0.0067	0.0046
	(0.0072)	(0.0072)	(0.015)
Life events	**0.0583*** **	**0.0521*** **	**0.0601*** **
	(0.0113)	**(0.0089)**	**(0.0182)**
N	7,625	7,625	7,625
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Morbidity assesses whether parents have had any symptoms of acute morbidity during the past four weeks: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.24: Child Migration and Unhealthy Days of Parents in Rural Areas

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0146****	**-0.0151****	**-0.0214***
	(0.0074)	**(0.0076)**	**(0.0128)**
Age	0.00301	**0.0041***	0.0063
	(0.0028)	**(0.0023)**	(0.0052)
Age squared	0.000006	-0.00001	0.000006
	(0.00002)	(0.00002)	(0.00005)
Education	0.0002	0.0001	0.0016
	(0.0009)	(0.0009)	(0.0031)
Working	**-0.0792*****	**-0.0602*****	-0.0046
	(0.0256)	**(0.0172)**	(0.0394)
BMI	-0.0012	-0.0011	-0.0019
	(0.0008)	(0.0008)	(0.0028)
Smoking	**-0.0289*****	**-0.0289*****	-0.0207
	(0.0067)	**(0.0069)**	(0.0209)
Household (HH) characteristics:			
HH size	**0.0032***	**0.00314***	**-0.0125****
	(0.0019)	**(0.0018)**	**(0.0053)**
Number of adults	-0.0037	-0.0035	0.0008
	(0.0032)	(0.0030)	(0.0054)
Log of HH assets	**0.0048****	**0.0048****	-0.0004
	(0.0022)	**(0.0021)**	(0.0054)
Land	**-0.0318*****	**-0.0307*****	-0.0002
	(0.0064)	**(0.0064)**	(0.0131)
Non-farm family business	0.0015	0.0011	0.0082
	(0.0065)	(0.0065)	(0.0126)
Life events	**0.0235*****	**0.0223*****	**0.0284*****
	(0.0078)	**(0.0077)**	**(0.0125)**
N	10,069	10,069	10,069
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Unhealthy days are the number of days missed due to poor health. The response are: 1 = had more than 5 unhealthy days in the last 4 weeks; 0 = had less than 5 unhealthy days in the last four weeks.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.25: Child Migration and Visits to Outpatient Care of Parents in Rural Areas

	Pooled OLS	Logit (Marginal Effect)	OLS Fixed Effect
Individual characteristics:			
Parent of migrant adult child	**-0.0155***	**-0.0147***	**-0.0151**
	(0.0083)	**(0.0088)**	**(0.0142)**
Age	0.0014	0.0016	0.0061
	(0.0027)	(0.0027)	(0.0055)
Age squared	0.000006	0.000003	-0.00002
	0.00002	(0.00002)	(0.00005)
Education	**0.00218****	**0.00189***	-0.0015
	(0.0011)	**(0.0011)**	(0.0034)
Working	-0.0051	-0.0071	-0.0226
	(0.0210)	(0.0192)	(0.0305)
BMI	0.00128	0.00106	-0.00049
	(0.0010)	(0.0009)	(0.0034)
Smoking	**-0.0507*****	**-0.0521*****	0.0321
	(0.0075)	**(0.0082)**	(0.0215)
Household (HH) characteristics:			
HH size	0.0004	0.00006	-0.0045
	(0.0021)	(0.00219)	(0.0052)
Number of adults	**-0.0074****	**-0.0073****	-0.0044
	(0.0034)	**(0.0035)**	(0.0060)
Log of HH assets	**0.0081*****	**0.0077*****	-0.0019
	(0.0024)	**(0.0024)**	(0.0051)
Land	**-0.0251*****	**-0.0244*****	-0.0029
	(0.0072)	**(0.0073)**	(0.0143)
Non-farm family business	0.0062	0.0072	0.0144
	(0.0074)	(0.0074)	(0.0137)
Life events	**0.0439*****	**0.0417*****	**0.0329****
	(0.0089)	**(0.0086)**	**(0.0138)**
N	10,599	10,599	10,599
Prob > F	0.0000	0.0000	0.0000

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Outpatient care is defined as visiting a public hospital, puskesmas, private hospital, clinic, health worker or doctor's practice or having been visited by a health worker or doctor in the last four weeks. The responses are: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.26: All Adult Child Migration and Parental Health Using the Fixed Effect Instrumental Variable (FE-IV)

	Self-rated health	Unhealthy days	Outpatient care	Morbidity	On medication
Individual characteristics:					
Parent of migrant adult child	**0.2170*** (0.0607)**	**-0.1650*** (0.0392)**	**-0.1226*** (0.0445)**	**-0.1855*** (0.0448)**	**-0.0929*** (0.0333)**
Age	-0.0038 (0.0054)	**0.0122*** (0.0035)**	0.0052 (0.0039)	**0.0082** (0.0041)**	**0.0072** (0.0030)**
Age squared	**-0.00008*** (0.00005)**	-0.00004 (0.00003)	-0.00001 (0.00003)	-0.00006 (0.00003)	0.000007 (0.00002)
Education	-0.0028 (0.0033)	0.00093 (0.0021)	0.0027 (0.0023)	-0.0013 (0.00297)	-0.0033 (0.0021)
Working	-0.0251 (0.0620)	0.0468 (0.0400)	-0.0166 (0.0442)	0.0731 (0.0563)	-0.0322 (0.0408)
BMI	**0.0095*** (0.0027)**	**-0.0053*** (0.0017)**	0.00094 (0.0018)	-0.0009 (0.0019)	-0.0017 (0.0014)
Smoking	0.0124 (0.0236)	**-0.0287*** (0.0152)**	0.02028 (0.01514)	-0.0160 (0.0191)	**-0.0358*** (0.0132)**
Household (HH) characteristics:					
HH size	0.0058 (0.0043)	**-0.0089*** (0.0028)**	**-0.0064** (0.0031)**	**-0.0296*** (0.0031)**	**-0.0084*** (0.0023)**
Number of adults	0.0010 (0.0053)	**0.0062*** (0.0034)**	-0.0043 (0.0037)	**0.0160*** (0.0041)**	0.0026 (0.0030)
Log of HH assets	-0.0015 (0.0046)	0.0016 (0.0030)	0.00122 (0.00331)	0.0011 (0.0036)	-0.0027 (0.0027)
Land	-0.0101 (0.0157)	-0.00046 (0.0102)	0.0041 (0.0113)	**-0.0198*** (0.0122)**	0.0063 (0.0089)
Non-farm family business	0.00201 (0.0126)	-0.0011 (0.0081)	0.0131 (0.0091)	-0.0047 (0.0098)	-0.0044 (0.0072)
Life events	-0.0103 (0.0129)	**0.0150*** (0.0083)**	**0.0264*** (0.0092)**	**0.0493*** (0.0116)**	0.0095 (0.0085)
N	16014	15993	17143	10478	10584
F-test of excluded instruments	641.25 (0.0000)	647.78 (0.0000)	687.36 (0.0000)	442.69 (0.0000)	433.80 (0.0000)
Under-identification test (Anderson canon. corr. LM statistic)	602.23 (0.0000)	607.907 (0.0000)	645.559 (0.0000)	412.51 (0.0000)	405.04 (0.0000)
Weak identification test (Cragg-Donald ***F*** statistic)	641.25 (0.0000)	647.784 (0.0000)	687.363 (0.0000)	442.69 (0.0000)	433.80 (0.0000)
Endogeneity test	6.45207 (0.0111)	9.35388 (0.0022)	6.50698 (0.0107)	18.4012 (0.0000)	7.10053 (0.0077)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.27: Son Migration and Parental Health Using the Fixed Effect Instrumental Variable (FE-IV)

	Outpatient care	Morbidity
Individual characteristics:		
Parent of migrant adult child	**-0.1302****	**-0.2188*****
	(0.0575)	**(0.0615)**
Age	0.0042	0.0067
	(0.0049)	(0.0054)
Age squared	0.000005	-0.00004
	(0.00004)	(0.00004)
Education	0.0029	-0.0014
	(0.0028)	(0.0037)
Working	0.0028	-0.0177
	(0.0273)	(0.0359)
BMI	0.0019	0.0012
	(0.0023)	(0.0025)
Smoking	**0.0327***	-0.0156
	(0.0184)	(0.0238)
Household (HH) characteristics:		
HH size	-0.0021	**-0.0312*****
	(0.0038)	**(0.0039)**
Number of adults	**-0.0092****	**0.0145*****
	(0.0045)	**(0.0051)**
Log of HH assets	0.0031	-0.0009
	(0.0040)	(0.0046)
Land	-0.00013	-0.0218
	(0.0139)	(0.0152)
Non-farm family business	0.0045	-0.0014
	(0.011)	(0.0122)
Life events	**0.02731****	**0.0445*****
	(0.0111)	**(0.0144)**
N	11508	6829
F-test of excluded instruments	426.77	244.90
	(0.0000)	(0.0000)
Under-identification test **(**Anderson canon. corr. LM statistic)	402.429	230.69
	(0.0000)	(0.0000)
Weak identification test (Cragg-Donald ***F*** statistic)	426.773	244.90
	(0.0000)	(0.0000)
Endogeneity test	11.6571	6.2922
	(0.0006)	(0.0121)

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy; 2 = somewhat healthy; 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1= at least one visit & 0 = no visit
On medication: 1 = yes; 0 = no
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.28. Daughter Migration and Parental Health Using the Fixed Effect Instrumental Variable (FE-IV)

	Self-rated health status	Morbidity
Individual characteristics:		
Parent of migrant adult child	**0.18678****	**-0.1168****
	(0.0774)	**(0.0600)**
Age	0.0037	-0.0015
	(0.0084)	(0.0065)
Age squared	**-0.0001***	0.00002
	(0.00007)	(0.00006)
Education	-0.0006	0.0058
	(0.0051)	(0.0049)
Working	0.0253	0.0393
	(0.0477)	(0.0409)
BMI	**0.0101****	0.00002
	(0.0042)	(0.00315)
Smoking	-0.0137	-0.0042
	(0.0366)	(0.0322)
Household (HH) characteristics:		
HH size	**0.0174*****	**-0.0321*****
	(0.0067)	**(0.0050)**
Number of adults	0.0104	**0.0157****
	(0.0078)	**(0.00655)**
Log of HH assets	-0.0049	0.0072
	(0.0071)	(0.0058)
Land	0.0121	-0.0099
	(0.0256)	(0.0212)
Non-farm family business	0.0210	-0.0185
	(0.0193)	(0.0161)
Life events	0.0024	**0.0652*****
	(0.0196)	**(0.0195)**
N	6881	3891
F-test of excluded instruments	584.27	355.69
	(0.0000)	(0.0000)
Under-identification test (Anderson canon. corr. LM statistic)	510.30	305.768
	(0.0000)	(0.0000)
Weak identification test (Cragg-Donald ***F*** statistic)	584.27	355.69
	(0.0000)	(0.0000)
Endogeneity test	4.7201	4.6502
	(0.0298)	(0.0311)

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy; 2 = somewhat healthy; 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.29: Child Migration and Health of Parents Aged 50+ Using the Fixed Effect Instrumental Variable (FE-IV)

	Unhealthy days	Morbidity
Individual characteristics:		
Parent of migrant adult child	**-0.1229***	**-0.3623****
	(0.0682)	**(0.08287)**
Age	-0.0041	**0.0169****
	(0.0072)	**(0.0080)**
Age squared	**0.00009***	-0.00009
	(0.00005)	(0.00006)
Education	0.00054	**0.0067***
	(0.0027)	**(0.0035)**
Working	0.0093	-0.0357
	(0.0244)	(0.03098)
BMI	**-0.0057****	-0.0025
	(0.0025)	(0.00281)
Smoking	**-0.0535*****	-0.0255
	(0.0175)	(0.0215)
Household (HH) characteristics:		
HH size	**-0.0073****	**-0.0252*****
	(0.0031)	**(0.0035)**
Number of adults	0.0059	**0.0211*****
	(0.0046)	**(0.0054)**
Log of HH assets	0.0062	-0.0018
	(0.0041)	(0.0049)
Land	-0.0089	-0.0259
	(0.0137)	(0.0165)
Non-farm family business	-0.0121	0.00150
	(0.01171)	(0.01371)
Life events	-0.0087	**0.04502*****
	(0.0118)	**(0.0161)**
N	9541	6394
F-test of excluded instruments	193.519	112.26
	(0.0000)	(0.0000)
Under-identification test (Anderson canon. corr. LM statistic)	187.523	109.184
	(0.0000)	(0.0000)
Weak identification test (Cragg-Donald ***F*** statistic)	193.519	112.260
	(0.0000)	(0.0000)
Endogeneity test	4.29843	17.1514
	(0.0382)	(0.0000)

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.30: Child Migration and Health of Parents Living in Rural Areas Using the Fixed Effect Instrumental Variable (FE-IV)

	Unhealthy days	Morbidity
Individual characteristics:		
Parent of migrant adult child	**-0.2255*** **	**-0.3172*** **
	(0.0622)	**(0.0735)**
Age	**0.0132** **	**0.0172*** **
	(0.0053)	**(0.0067)**
Age squared	-0.00005	**-0.00013** **
	(0.00004)	**(0.00006)**
Education	0.0011	-0.0056
	(0.0032)	(0.0045)
Working	-0.0223	-0.0022
	(0.0336)	(0.0449)
BMI	-0.0025	**-0.0063***
	(0.0028)	**(0.0033)**
Smoking	-0.0236	**-0.0529***
	(0.0227)	**(0.0305)**
Household (HH) characteristics:		
HH size	**-0.0123*** **	**-0.0285*** **
	(0.0045)	**(0.0053)**
Number of adults	0.0050	**0.01605** **
	(0.0056)	**(0.0071)**
Log of HH assets	-0.0025	-0.0041
	(0.0050)	(0.0064)
Land	0.0070	-0.017
	(0.0136)	(0.0174)
Non-farm family business	0.0038	-0.0074
	(0.0128)	(0.0164)
Life events	**0.0286*** **	**0.0557*** **
	(0.0125)	**(0.0189)**
N	7190	4329
F-test of excluded instruments	207.162	131.37
	(0.0000)	(0.0000)
Under-identification test (Anderson canon. corr. LM statistic)	198.114	125.157
	(0.0000)	(0.0000)
Weak identification test (Cragg-Donald ***F*** statistic)	207.162	131.371
	(0.0000)	(0.0000)
Endogeneity test	8.65005	13.0144
	(0.0033)	(0.0003)

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy; 2 = somewhat healthy; 3 = very healthy
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.31: Child Migration and Household Per-Capita Total Expenditure

	Pooled OLS	FE	FE-IV
Individual characteristics:			
Parent of migrant adult child	**0.0745*** **	**0.079*** **	**0.4314*** **
	(0.0151)	**(0.0204)**	**(0.087)**
Age	0.0350***	0.1664***	0.1539***
	(0.0048)	(0.0100)	(0.0082)
Age squared	-0.00024***	-0.0004***	-0.0003***
	(0.00004)	(0.0001)	(0.00007)
Education	0.0508***	**0.0111*** **	0.0111***
	(0.0017)	**(0.0041)**	(0.0041)
Working	-0.0451	-0.2668***	-0.2747***
	(0.0686)	(0.0890)	(0.0752)
BMI	0.0269***	0.0144***	**0.0149*** **
	(0.0015)	(0.0037)	**(0.0037)**
Smoking	**-0.0243* **	**0.0530* **	**0.05653** **
	(0.0126)	**(0.0286)**	**(0.0272)**
Household (HH) characteristics:			
HH size	-0.0029***	-0.0252***	**-0.0163* **
	(0.0033)	(0.0083)	**(0.0086)**
Number of adults	-0.0789***	-0.0610***	-0.0680***
	(0.0051)	(0.0076)	(0.0071)
Log of HH assets	**0.2775*** **	**0.1258*** **	0.1261***
	(0.0043)	**(0.0067)**	(0.0061)
Land	**-0.0786*** **	**0.1006*** **	0.0973***
	(0.0120)	**(0.0228)**	(0.0226)
Non-farm family business	0.1145***	0.06924***	0.0753***
	(0.0115)	(0.0162)	(0.0166)
Life events	**-0.2424*** **	**-0.0032**	**0-.0051**
	(0.0130)	**(0.0148)**	**(0.0152)**
N	16,556	16,556	12191
F-test of excluded instruments			414.719
			(0.0000)
Under-identification test (Anderson canon. corr. LM statistic)			392.558
			(0.0000)
Weak identification test (Cragg-Donald *F* statistic)			414.719
			(0.0000)
Endogeneity test			43.2572
			(0.0000)

Standard errors in parentheses.
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.32: Son Migration; Mean and Standard Deviation of All variables Parent of MSHs and Non-MSHs Using IFLS Panel Data 1997, 2000, 2007 & 2014

Variable	Parents with migrant children		Parents without migrant children	
	Mean	**SD**	**Mean**	**SD**
Outcome variable:				
Self-rated health status	1.906	0.513	1.896	0.533
Unhealthy days	0.115	0.319	0.114	0.318
Outpatient care	0.146	0.353	0.163	0.369
Morbidity	0.090	0.287	0.110	0.312
On medication	0.0311	0.173	0.053	0.224
Independent variable:				
Parent age	51.96	9.22	49.38	9.38
Parent age (square)	2785.74	1009.1	2527.89	1005.39
Parent education	6.236	3.584	7.266	3.822
Parent work	0.927	0.260	0.956	0.203
BMI	21.857	3.635	22.365	3.940
Smoking	0.323	0.468	0.301	0.459
Household (HH) size	6.866	2.36	6.027	2.48
Number of adults living in households	4.939	1.62	4.709	1.700
Log of HH assets	16.775	1.664	17.181	1.788
Land for farm (yes/no)	0.390	0.487	0.285	0.451
Non-farm family business (yes/no)	0.385	0.486	0.4435	0.495
Life events	0.215	0.410	0.195	0.396

Source: IFLS 199, 2000, 2007 & 2014

Table 4.33: Daughter Migration; Mean and Standard Deviation of All variables Parent of MSHs and Non-MSHs Using IFLS Panel Data 1997, 2000, 2007 & 2014

Variable	Parents with migrant children		Parents without migrant children	
	Mean	**SD**	**Mean**	**SD**
Outcome variable:				
Self-rated health status	1.935	0.502	1.906	0.525
Unhealthy days	0.105	0.307	0.128	0.334
Outpatient care	0.134	0.341	0.162	0.369
Morbidity	0.094	0.292	0.112	0.315
On medication	0.0287	0.167	0.050	0.218
Independent variable:				
Parent age	51.07	9.03	48.74	9.44
Parent age (square)	2690.06	970.19	2465.52	1006.57
Parent education	6.058	3.478	7.556	3.874
Parent work	0.933	0.249	0.944	0.229
BMI	22.380	4.058	23.406	4.139
Smoking	0.343	0.474	0.282	0.450
Household (HH) size	7.082	2.617	6.691	2.486
Number of adults living in households	5.009	1.703	4.796	1.735
Log of HH assets	16.723	1.763	17.233	1.799
Land for farm (yes/no)	0.435	0.495	0.269	0.443
Non-farm family business (yes/no)	0.365	0.481	0.464	0.498
Life events	0.223	0.416	0.194	0.396

Source: IFLS 1997, 2000, 2007 & 2014

Table 4.34: Mean and Standard Deviation of All variables of Parent age 50+ of MSHs and Non-MSHs Using IFLS Panel Data 1997, 2000, 2007 & 2014

Variable	Parents with migrant children		Parents without migrant children	
	Mean	SD	Mean	SD
Outcome variable:				
Self-rated health status	1.830	0.546	1.815	0.551
Unhealthy days	0.134	0.341	0.149	0.356
Outpatient care	0.158	0.364	0.172	0.377
Morbidity	0.109	0.311	0.130	0.336
On medication	0.0619	0.241	0.075	0.264
Independent variable:				
Parent age	61.518	8.990	60.762	9.053
Parent age (square)	3865.337	1193.86	3774.045	1196.15
Parent education	5.766	4.141	6.189	4.251
Parent work	0.902	0.297	0.937	0.241
BMI	22.053	4.057	22.377	4.131
Smoking	0.3306	0.470	0.304	0.460
Household (HH) size	7.171	2.877	6.732	2.676
Number of adults living in households	5.199	1.900	4.776	1.734
Log of HH assets	17.197	1.801	17.355	1.829
Land for farm (yes/no)	0.3711	0.483	0.305	0.406
Non-farm family business (yes/no)	0.354	0.478	0.434	0.495
Life events	0.162	0.369	0.184	0.387

Source: IFLS 1997, 2000, 2007 & 2014

Table 4.35: Mean and Standard Deviation of All variables of Parent age of MSHs and Non-MSHs Living in Rural Area Using IFLS Panel Data 1997, 2000, 2007 & 2014

Variable	Parents with migrant children		Parents without migrant children	
	Mean	SD	Mean	SD
Outcome variable:				
Self-rated health status	1.913	0.513	1.903	0.523
Unhealthy days	0.103	0.304	0.111	0.315
Outpatient care	0.138	0.345	0.158	0.364
Morbidity	0.084	0.277	0.109	0.312
On medication	0.020	0.141	0.029	0.170
Independent variable:				
Parent age	51.049	9.360	48.375	10.121
Parent age (square)	2693.6	1013.0	2442.6	1077.18
Parent education	5.446	3.227	6.039	3.507
Parent work	0.938	0.241	0.965	0.182
BMI	21.857	3.635	22.365	3.940
Smoking	0.351	0.477	0.348	0.476
Household (HH) size	6.799	2.449	6.266	2.269
Number of adults living in households	4.725	1.569	4.230	1.412
Log of HH assets	16.546	1.558	16.753	1.664
Land for farm (yes/no)	0.555	0.497	0.500	0.500
Non-farm family business (yes/no)	0.340	0.473	0.384	0.486
Life events	0.229	0.420	0.220	0.414

Source: IFLS 1997, 2000, 2007 & 2014

Table 4.36: First stage estimates of the FE-IV model for All Adult Child Migration

	Self-rated health	Unhealthy days	Outpatient care	Morbidity	On medication
Dependent variable Parent MSHs=1					
Individual characteristics:					
Migration rate in community	**0.0574*** (0.002)**	**0.0574*** (0.002)**	**0.0570*** (0.0021)**	**0.0557*** (0.002)**	**0.0553*** (0.002)**
Age	0.0257*** (0.0033)	0.0257*** (0.003)	0.0256*** (0.0032)	0.0271*** (0.004)	0.0269*** (0.004)
Age squared	-0.0002*** (0.00003)	-0.0002*** (0.00003)	-0.0002*** (0.00003)	-0.0002*** (0.00003)	-0.0002*** (0.00003)
Education	-0.0017 (0.0021)	-0.0017 (0.002)	-0.0014 (0.0020)	-0.002 (0.0031)	-0.0021 (0.0031)
Working	0.0005 (0.0403)	0.0005 (0.040)	0.0019 (0.0381)	-0.0902 (0.060)	-0.0873 (0.059)
BMI	0.000008 (0.0017)	0.00009 (0.0017)	-0.0002 (0.0016)	-0.0018 (0.0021)	-0.0022 (0.0021)
Smoking	0.0085 (0.0153)	0.0060 (0.015)	0.0131 (0.013)	-0.003 (0.0204)	-0.0043 (0.0192)
Household (HH) characteristics:					
HH size	-0.0082*** (0.0028)	-0.0081*** (0.0028)	-0.0081*** (0.0027)	-0.000002 (0.0033)	-0.0006 (0.0033)
Number of adults	0.0182*** (0.003)	0.0180*** (0.003)	0.0175*** (0.0032)	0.0153*** (0.0043)	0.016*** (0.004)
Log of HH assets	-0.007** (0.003)	-0.007** (0.0030)	-0.0061** (0.0028)	-0.0059 (0.0039)	-0.0052 (0.0039)
Land	0.0101 (0.0102)	0.0105 (0.010)	0.0097 (0.0097)	0.0241* (0.0129)	0.0276** (0.0129)
Non-farm family business	-0.026*** (0.008)	-0.0262*** (0.0081)	-0.025*** (0.0077)	-0.037*** (0.0103)	-0.0377*** (0.0103)
Life events	0.0125 (0.008)	0.0119 (0.0084)	0.0133* (0.008)	0.0113 (0.0123)	0.0164 (0.0123)
N	16014	15993	17143	10478	10584
F-test of excluded instruments	641.25 (0.000)	639.76 (0.000)	677.39 (0.000)	436.41 (0.000)	427.08 (0.000)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.37: First stage estimates of the FE-IV model for Son Migration

	Outpatient care	Morbidity
Dependent variable		
Parent MSHs=1		
Individual characteristics:		
Migration rate in community	**0.0581*** **	**0.0539*** **
	(0.0028)	**(0.0034)**
Age	0.0240***	0.0278***
	(0.004)	(0.0053)
Age squared	-0.0001***	-0.0002***
	(0.00003)	(0.00004)
Education	-0.0017	-0.0038
	(0.0024)	(0.0038)
Working	-0.0922***	-0.1623***
	(0.0225)	(0.0356)
BMI	0.0016	0.0004
	(0.0020)	(0.0026)
Smoking	-0.0076	-0.0041
	(0.0155)	(0.0247)
Household (HH) characteristics:		
HH size	-0.0074**	-0.0041
	(0.0032)	(0.0247)
Number of adults	0.0096**	-0.0016
	(0.0038)	(0.0041)
Log of HH assets	-0.0026	0.0061
	(0.0033)	(0.0053)
Land	0.0127	-0.0067
	(0.0117)	(0.0048)
Non-farm family business	-0.0193**	0.0139
	(0.0092)	(0.0157)
Life events	0.0056	-0.0275**
	(0.0094)	(0.0126)
N	11508	6829
F-test of excluded instruments	426.77	244.90
	(0.000)	(0.000)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.38: First stage estimates of the FE-IV model for Daughter Migration

	Self-rated health	Morbidity
Dependent variable		
Parent MSHs=1		
Individual characteristics:		
Migration rate in community	**0.1261*** **	**0.1269*** **
	(0.005)	**(0.0067)**
Age	0.0086**	0.0115**
	(0.004)	(0.0057)
Age squared	-0.00004	-0.00006
	(0.00004)	(0.00005)
Education	-0.0035	0.0088**
	(0.0027)	(0.0043)
Working	-0.0682***	-0.0963***
	(0.0253)	(0.0359)
BMI	0.0002	-0.0026
	(0.0022)	(0.0027)
Smoking	0.0523***	0.0264
	(0.0194)	(0.0286)
Household (HH) characteristics:		
HH size	-0.0056	0.0007
	(0.0036)	(0.004)
Number of adults	0.0145***	0.0122**
	(0.004)	(0.0057)
Log of HH assets	-0.0048	-0.0004
	(0.0037)	(0.0052)
Land	-0.0061	0.0183
	(0.0137)	(0.0187)
Non-farm family business	-0.0238**	-0.0154
	(0.0103)	(0.0142)
Life events	0.0153	0.024
	(0.0105)	(0.0173)
N	6881	3891
F-test of excluded instruments	580.99	352.84
	(0.000)	(0.000)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.39: First stage estimates of the FE-IV model for All Adult Child migration and Parents Aged 50+

	Unhealthy days	Morbidity
Dependent variable		
Parent MSHs=1		
Individual characteristics:		
Migration rate in community	**0.0395*** **	**0.0367*** **
	(0.002)	**(0.0034)**
Age	0.0247***	0.0155*
	(0.0075)	(0.0091)
Age squared	-0.0001**	-0.00005
	(0.00005)	(0.00007)
Education	-0.0036	0.0005
	(0.0029)	(0.004)
Working	-0.0088**	-0.1241***
	(0.0034)	(0.0329)
BMI	-0.0011	-0.0031
	(0.0026)	(0.0031)
Smoking	0.0038	-0.004
	(0.0185)	(0.0245)
Household (HH) characteristics:		
HH size	-0.0066*	0.0016
	(0.0034)	(0.0040)
Number of adults	0.022***	0.0172***
	(0.0047)	(0.006)
Log of HH assets	-0.0090**	-0.0074
	(0.0042)	(0.005)
Land	0.0221	0.0529***
	(0.0142)	(0.017)
Non-farm family business	-0.039***	-0.0374**
	(0.0121)	(0.0152)
Life events	0.009	0.0130
	(0.0124)	(0.0183)
N	9541	6394
F-test of excluded instruments	195.74	112.26
	(0.000)	(0.000)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

Table 4.40: First stage estimates of the FE-IV model for All Adult Child migration and Parents Live in Rural Areas

	Self-rated health	Morbidity
Dependent variable		
Parent MSHs=1		
Individual characteristics:		
Migration rate in community	**0.0475***** **(0.003)**	**0.044***** **(0.0039)**
Age	0.0322*** (0.0054)	0.0343*** (0.007)
Age squared	-0.0002*** (0.00005)	-0.0002*** (0.00006)
Education	-0.0025 (0.003)	0.0017 (0.0053)
Working	-0.0894** (0.0370)	-0.0852* (0.0527)
BMI	-0.0036 (0.003)	-0.002 (0.003)
Smoking	-0.0153 (0.0252)	-0.0412 (0.0360)
Household (HH) characteristics:		
HH size	-0.008 (0.0051)	-0.0069 (0.0064)
Number of adults	0.0224*** (0.006)	0.0236*** (0.0082)
Log of HH assets	-0.0110** (0.005)	-0.007 (0.0076)
Land	0.0216 (0.0150)	0.0411** (0.0202)
Non-farm family business	-0.0253* (0.0142)	-0.0492** (0.0191)
Life events	0.0036 (0.014)	-0.0052 (0.0224)
N	7200	4329
F-test of excluded instruments	209.46 (0.000)	131.37 (0.000)

Standard errors in parentheses
*Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.
Self-rated health:1 = somewhat unhealthy & unhealthy, 2 = somewhat healthy and 3 = very healthy.
Unhealthy: 1 = had more than 5 unhealthy days; 0 = had less than 5 unhealthy days.
Morbidity: 1 = had more than 7 morbidity symptoms; 0 = had less than 7 morbidity symptoms.
Outpatient care: 1 = at least one visit; 0 = no visit.
Source: IFLS 1997, 2000, 2007 & 2014

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Chapter 5: Parental Health Shocks and the School Outcomes of Children—Evidence from Indonesian Panel Data

5.1 Introduction

Education is an important key for eradicating poverty and promoting shared prosperity (World Bank 2018). Schooling improves human capital and drives economic growth and international convergence (Barro 1991; Benhabib & Spiegel 1994; Barro & Sala-i-Martin 1995). Childhood education plays an important role in alleviating poverty and promoting economic growth. Extensive research on the determinants of children's educational outcomes point to parental human capital as the main determinant (Haveman & Wolfe 1995). Investment in education as well as health promotes a higher quality of human capital and so contributes to high labour productivity and promotes higher income (Sylwester 2000). Parental education, cognitive ability and educational expectations determine children's educational attainment; however, economic disadvantage affects parental assessment of the future and so contributes to the low educational attainment of children (Crosnoe, Mistry & Elder 2002)

Investment in children's human capital is reflected in improvements to future economic and social wellbeing. At the same time, early life conditions and one's socio-economic environment during childhood affects educational outcomes and future health. Parental socio-economic resources contribute to children's outcomes throughout their life (Ermisch, Jäntti & Smeeding 2012). The educational outcomes of children are strongly supported by parental engagement and availability during children's lives (Epstein 2001).

This study looks at the impact of co-resident parental health shocks on several educational outcomes for children. Parental illness may result in consequences that differ to other sources of family disruptions. In addition to increasing medical expenditures,

parental illnesses increase the time constraints of other healthy family members; indeed, there is no time limit to the duration of an illness, which makes it difficult to adjust (Lim 2017). Households with ill parents put children at risk of adjustment difficulties; parental illness is a stressful event for children and adolescents (see e.g., Pedersen & Revenson 2005). Limited access to formal health insurance, credit markets and medical facilities in developing economies exacerbate the household burden of parental illness over time.

This study uses a long-spanning longitudinal dataset containing four waves of data taken from 1997 to 2014 from the IFLS. I explore several types of health shock measurements and estimate the possible impact of parental health shocks on several educational outcomes. Unlike previous studies, I explore school enrolment, working activities and the possibility of grade repetition and cognitive assessment to capture children's school attainment. Parental illness may reduce parental time for supervision of children's studies; this may affect educational achievements such as test scores and grade repetition. The sole use of school attendance when measuring children's educational attainments has shortcomings, as it ignores certain complications surrounding educational attainment (Amuedo-Dorantes, Georges & Pozo 2010). This study explores the impact of parental illness on children aged 6–14 years and 15–24 years using a child-level FE method, and investigates possible gender differentials on children's outcomes.

5.2 Background (Indonesian Setting)

Ill health events can cause significant adverse economic outcomes for households in developing countries. Health shocks result in medical expenses, the indirect cost of seeking treatment and reduced income. Studies on the economic risk of illness in Indonesia reported some of the economic consequences of ill health events, such as a 10 per cent decrease in per capita income of baseline earning, 7 per cent decrease in hours

of labour supply relative to baseline, an approximate 20 per cent decrease in per capita non-medical consumption (Gertler & Gruber 2002), and an approximate 4 per cent decrease in monthly per capita food consumption (Genoni 2012). In response to health shocks, households in Indonesia take out loans and sell assets (Modena & Gilbert 2011). Borrowing and drawing from savings and assets are some informal coping strategies undertaken by Indonesian households during periods of ill health; this will have a possible negative long-term impact (Sparrow et al. 2014).

Insufficient government health expenditure has resulted in a lack of health facilities and medical staff compared to any other South-East Asian country. For every 1000 people, there is one hospital bed and less than one (0.3) doctor; this number is below the average for other OECD countries (OECD 2015). Indeed, in 2015, around 49.4 per cent of the Indonesian population was not covered by basic health insurance (BPS 2015). Following the implementation of the National Health Insurance Scheme in 2014 (*Jaminan Kesehatan Nasional*, JKN), 32 per cent of the Indonesian population remained uncovered by universal basic health care (Johar et al. 2017).

This study explores the impact of parental health shocks on children's school outcomes in Indonesia, a developing country with complex disease epidemiology patterns. While epidemiological transitions show an increase in non-communicable diseases, infectious diseases remain an important part of the disease burden; indeed, almost 111 million people at the bottom of society suffer from an extreme level of neglected tropical diseases (WHO 2017). For example, Indonesia is among the top ten countries in the world with the highest tuberculosis and diabetes rates (WHO 2013). With a population of more than 250 million people in 2016, the morbidity rate of the Indonesian population reached more than 16 per cent in 2015—a 2 per cent increase from 2014.

When the 2015 National Socio-Economic Survey (SUSENAS) was taken, more than 30 per cent of Indonesian people reported some health limitations during the previous month (BPS 2016a). The percentage of health complaints has increased over the last decade. Indonesia spends very little on health expenditure compared to other countries in South-East Asia and the western Pacific. At 3 percent of GDP in 2012, Indonesia's health expenditure was lower than other low- and middle-income countries, such as India and the Philippines (WHO 2015).

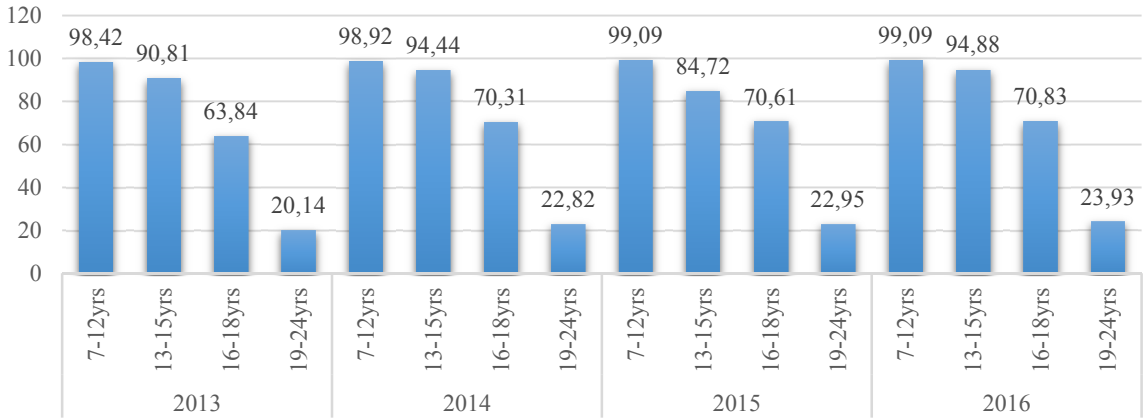

Figure 5.1: Education Participation, 2013–2016 (%)

Source: The Indonesian Central Bureau of Statistics (BPS) and the National Socio-Economic Survey (SUSENAS).

Government efforts to expand and provide equality of opportunity and quality education for all Indonesian people has resulted in tremendous progress. Indonesia has made significant progress in achieving a universal six years of basic primary education for children aged 7–12 years. In 1994, nine years of compulsory education was targeted. In 2015, only 0.91 per cent of the population aged 7–12 years did not attend formal education. However, around 5.28 per cent of the population aged 13–15 years did not attend school (Welfare Indicator Indonesia 2016). The higher the school age group, the lower the school participation rate (Figure 5.1). Further, around one million children between the ages of 7–15 years are out of school, in addition to 3.6 million adolescents

aged 16–18 (SUSENAS 2016). Indeed, adolescents and youths from the poorest households are much less likely to complete their education, and only half of primary school children from low-income families achieved the minimum national benchmark in reading, while less than a quarter did so in mathematics (Indonesia Ministry of National Development Planning and the United Nations Children's Fund 2017).

SUSENAS reported that, on average, girls aged above 15 years completed fewer years of schooling than boys in both urban and rural areas. Although the number of years of schooling for both female and male populations has increased, from 2005 to 2015, girls consistently completed fewer years of school than boys (Figure 5.2).

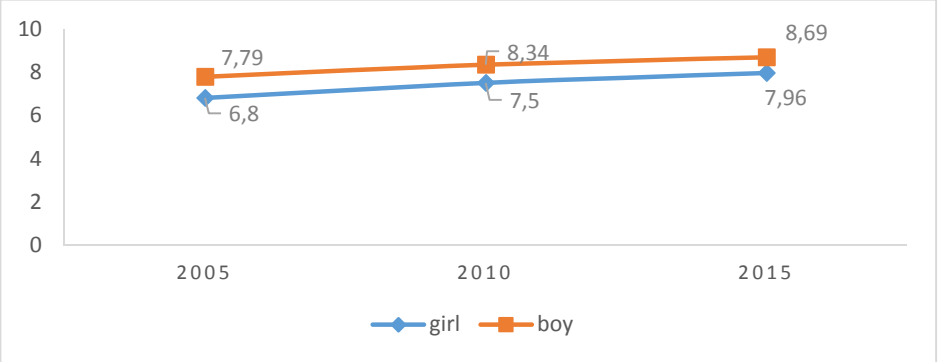

Figure 5.2: Average Years of Schooling for Children Aged 15 Years and Above by Sex, 2005–2015

Source: The National Socio-Economic Survey (SUSENAS) KOR 2005–2015.

This study uses a long-spanning longitudinal dataset, containing four waves of data from 1997 to 2014. I explore several types of measurements of health shocks, estimating the possible impact of parental health shocks on several educational outcomes—school hours, school enrolment, possible work, grade repetition and cognitive assessment—using a child-level FE model, and including children and adolescents. I also analyse possible gender differentials on the impact of parental illness on educational outcomes.

5.3 Literature Review

Health shocks severely affect households in two ways: 1) in a system with no social protection mechanisms or basic health insurance, out-of-pocket health care expenditures, such as medical costs or the indirect costs of seeking treatment, necessarily increases; 2) the loss of workdays results in reduced income or a loss of income (Wolfe & Hill 1995; Hoel 2002; Sparrow et al. 2014). Studies in low- and middle-income countries in Asia show that about 4 per cent of households in India are impoverished by ill health (Joe & Mishra 2009; Ghosh 2011); in Vietnam, the figure is about 3 per cent (Van Minh et al. 2013); in the Philippines, it is 14 per cent (Ico 2008).

Households respond to increases in catastrophic expenditures related to medical costs and the loss of income or reduced income by adopting several coping strategies. If the financial markets are imperfect, households may adopt informal coping strategies; for example, they may readjust daily expenditures, leading to reduced food consumption and increased risk of poverty. The decrease in consumption is significant for households located further from financial institutions in Indonesia (Gertler, Levine & Moretti 2009). In Bangladesh, access to microcredit helps to insure consumption when households experience loss of income due to illness or death (Islam & Maitra 2012); in Vietnam, households take out loans and reduce consumption during family hospitalisations (Nguyen et al. 2012); in Mexico, households turn to the pawning of goods to finance out-of-pocket health expenditures (Raccanello, Anand & Dolores 2007).

Parental health shocks adversely influence a household's ability to contribute to children's educational outcomes. With an increase in out-of-pocket medical expenditures, ill health reduces a household's ability to afford their children's education. Reasons to leave school become more significant when households view children as a substitute for

parental labour. Children might be required to work while at school to supplement the household income (Dercon & Krishnan 2000; Johnson & Reynolds 2013). The labour supply of other members of poor households also increases during ill health events to compensate for income losses (Berloffa & Modena 2009). While there is less productivity, parents with poor health are more likely put pressure on children to join the labour market and/or to take care of them. This reduces the time that children have for school.

An extensive literature documents the economic impact of ill health events on households in low- and middle-income economies; however, few studies focus on parental health and its impact on children. Yung-Chi Chen (2017) highlighted the impact of parental chronic illness on children's educational achievements and school behaviour; however, there are few other studies on this topic, even in psychology. Anderson and Hammern (1993) pointed to the importance of academic achievement in predicting possible future psychosocial disorders. This study examines both school enrolment and school attainment.

Those few studies that have focused on the impact of parental health shocks on children's school outcomes have used developing countries as their setting. Recent studies on this topic come from Bosnia and Herzegovina, Tanzania, China and Rwanda. These conclude that parental health shocks have a negative impact on children's school outcomes; however, there are differences in terms of which parent's ill health—mother or father—has the greatest impact. For example, Bratti and Mendola (2014) showed that maternal health shocks affect schooling in Bosnia and Herzegovina, yet Alam (2015) demonstrated that paternal health shocks negatively affect school attendance. Dhanaraj (2016) explored the differential effects of father's and mother's health shocks on different cohort groups in India. He investigated the timing of health shocks and their impact on

human capital investment, including school attainment. Using a longitudinal dataset (the Young Lives project) and applying a conditional logit model with community FE, Dhanaraj found that, while maternal health shocks delayed enrolment and age-specific grade attainments for younger cohorts, paternal illness or death led to significantly higher drop out rates and lower school attainment for children in the older cohort. Our study seeks to capture educational outcomes via school enrolment (e.g., hours in school, attending school and work for pay) and school attainment (e.g., grade repetition and cognitive assessment). It is conscious of possible gender bias and covers both children and adolescents.

When investigating the impact that household-level shocks had on investment in human capital, Liu (2016) took into account the role of insurance against health shocks. He showed that parental health shocks that involved both the head of a household and a spouse decreased the rate of school enrolment. He also showed that, when the household was uninsured, there was a positive impact on children's employment, and that health shocks involving the head of households had a greater impact than those of the spouse. The mitigating role of health insurance was also addressed by Woode (2017) who found that paternal illnesses had a negative impact on school attendance for households without mutual health insurance.

This study contributes to the literature in several ways. First, it investigates the impact of parental health shocks on children's school outcomes, covering both school enrolment and school attainment. Second, it investigate possible gender differentials on children's school outcomes. Third, it uses several types of parental health shock measurements and long-spanning longitudinal data.

5.3.1 On the Indonesian Context

Indonesian-centred studies on the relationship between parental socio-economic resources and children's outcomes mainly focus on health outcomes. Most studies have investigated the impact of household financial resources and parental health on children's general health, measuring height and weight (Cameron & Williams 2009) or maternal education and children's outcomes (Beegle, Frankenberg & Thomas 2001; Quisumbing & Maluccio, 2003; Suryadarma, Pakpahan & Suryahadi 2009). Nobles and Frankenberg (2009) focused on a mother's access to social capital as one of the parental socio-economic resources that contributes to children's health outcomes.

Household wealth is a primary determinant in school enrolment (Behrman & Knowles 1999). Studies in Indonesia show evidence of the importance of household wealth in secondary school enrolment (Suryadarma, Suryahadi & Sumarto 2006); indeed, children living in wealthier communities are more likely to attend school (Takahashi, 2011). Research shows that a mother's assets at marriage have a positive effect on their son's schooling (Quisumbing & Maluccio 2003) and that high levels of parental education reduce the probability of non-enrolment or delayed entry of children at school (Pradhan 1998). The inability to pay transportation costs is the main reason for children not attending junior secondary school in at least two provinces (Bali and West Nusa Tenggara) in Indonesia (Hardjono 2004; see also Jones 2003).

Any household disruptions may negatively affect school enrolment. This view is supported by evidence that, during the Indonesian economic crisis in 1997–1998, both drop outs and delayed enrolment significantly contribute to decrease in school attendance (Frankenberger et al. 1999). In addition, there was a small reduction in school attendance during the crisis (Cameron 2001). Focusing on parental death as a source of disruption,

Gertler, Levine and Ames (2004) reported that orphaned children are twice as likely to drop out from school. Other research shows that maternal orphans are more likely to have 0.6 to 1.7 fewer years of schooling compared to non-orphans (Suryadarma, Pakpahan & Suryahadi 2009).

There are very few studies that focus on the relationship between parental socio-economic resources, specifically parental health, and children's outcomes in the areas of education in Indonesia. Most of these focus on parental socio-economic resources and children's education, investigating a quantitative aspect of education, such as current enrolment or time spent at school, and the impact of household expenditure. Very few studies examine children's cognitive outcomes. Existing literature shows that households are unable to fully smooth income losses from moderate and severe illness (Gertler & Gruber 2002; Sparrow et al. 2014) and that the labour supply of other family members increases following parental illness (Berloffa & Modena 2009). While conflicting findings have been reported regarding the impact of parental death on school enrolment and years of schooling (Suryadarma, Pakpahan & Suryahadi 2009), there is limited evidence of the impact of parental health shocks on school attainment. This essay complements earlier research by analysing the impact of parental health shocks on children's school outcomes, including both school enrolment and school attainment.

This study extends the existing literature in several ways. It estimates the impact of parent health shocks on both school enrolment and school attainment, exploring grade repetition and cognitive assessment. Using a long-spanning longitudinal dataset, comprising four waves of data from 1997 to 2014, it explores several types of measurements of parental health shocks and uses a child-level FE model. Further, it investigates two age groups, covering children and adolescents, and estimates possible gender differentials on children's school outcomes.

5.4 Data

This study uses data from the IFLS, a continuing longitudinal socio-economic and health survey that has existed since 1993. It is the only ongoing longitudinal survey in Indonesia that collects extensive information at the individual, household and community level on large-scale socio-economics, health, household demographics and economic characteristics, consumption and health expenditure, and people's access to health care facilities. The IFLS collects detailed information on measures of health status, including self-reported measures of general health status, symptoms and pain. As a result, the data can be used to explore relationships between health status and educational outcomes. Information on children's education and health is derived from Book-5 IFLS. Book-5 collects information about children younger than 15 years. Questions are answered by the mother, or caretaker, if the child is younger than 11; children between the ages of 11 and 14 are allowed to respond for themselves.

The IFLS contains longitudinal data with a low attrition rate (Strauss et al. 2004). Since 1997, the IFLS has managed to re-contact at least one member from 19 out of every 20 target households (Thomas et al. 2012). The re-contact rates of each wave of the IFLS are as high as, or higher than, most longitudinal surveys in the US and Europe (Strauss, Witoelar & Sikoki 2016). An IFLS sample of households represents about 83 per cent of the Indonesian population. The most recent wave, conducted in 2014, contained interviews with 16,204 households and 50,148 individuals. We study children's educational outcomes using four waves of this data that span a period of 17 years from 1997 to 2014. Using pidlink, a unique identity that links individual respondent to their data in each of IFLS survey year, this study constructed a panel data. With an unbalanced panel, this study includes 11,262 children of age 15 to 24 years and 21.489. Table 5.4 describe information on two groups of children and their school outcomes.

To investigate the impact of parental health shocks on children's school outcomes, we identified parents who lived with their children. We constructed two groups of children: 6–14 years and 15–24 years. Among women aged over 10, around 11 per cent had their first marriage before they turned 16 (BPS 2015). To ensure that our sample are children of school age and not married, we added a 'not married' criteria for children in the older group.

Based on the 2003 Indonesian Education Act (Article 6.1), Indonesia implemented a target of nine years of compulsory education, which consists of six years at elementary level for children aged 7–12, and three years at junior-level secondary school for children aged 13–15 (Barakat & Bengtsson 2018). There are two reasons to use children aged 6–14 years in our sample group. First, children are allowed to start to enrol at elementary school at the age of six. This is based on the 2003 Indonesian Education Act, which states that '[e]very citizen can enrol in a compulsory basic education program at the age of six' (Article 34.1). Second, even though nine years of education are compulsory for children aged 7–15 years, 15 is the minimum formal working age. Therefore, we placed 6–14 year-olds in one category. Information about this age group derives from Book-5 of the IFLS, which specifically collects information on children aged under 15 years. The IFLS considers respondents as adults at a minimum age of 15 years, which is why children aged 15–24 comprise this study's second group of children. Children aged 15–24 years are considered to be at senior secondary school and higher education level in Indonesia. The IFLS administered a cognitive assessment for two groups of children aged 7–14 and 15–24 years old to assess their general cognitive level, as well as their skills in mathematics. We closely followed this age-range categorisation.

5.4.1 Health Shocks Variables

One of the main advantages of using IFLS data is that it includes extensive measures of health status and SRH, morbidity experiences, physical health assessments and information on the use of health facilities. Strauss and Thomas (1998) highlighted the distinct components of health that can be measured and interpreted separately. For this reason, various indicators of health are examined individually in association with parental health shocks: 1) SRH status, 2) ADL 3) acute morbidity symptoms and 4) number of unhealthy days. As the key independent variables, these parental health shocks are summarised in Table 5.1. The parental health characteristics of the two groups of children are described in Table 5.2.

SRH is a four response category to assess respondents' general health. It is dichotomised into good or poor health status. Despite doubts about the validity of using self-reports of health for assessing a population's health, the WHO and the EUC have recommended self-rating one's health for the purposes of monitoring (de Bruin et al. 1996). In addition to mortality and morbidity, objective health outcomes have been well predicted by SRH indicators (Idler & Benyamini 1997; Van Doorslaer & Jones 2003), as they predict chronic disease (Shadbolt 1997) and are a strong indicator for disease and mortality (McGee et al. 1999). For example, in Indonesia, respondents reported that poor health was significantly linked to morbidity and subsequent mortality (Frankenberg & Jones 2004; Nawi et al. 2010).

In SRH, the respondent is asked: 'In general, how is your health?' The four response categories are: '4 = unhealthy', '3 = somewhat unhealthy', '2 = somewhat healthy' and '1 = very healthy'. The SRH variable is dichotomised into a binary variable equal to '1' if any of the parents report good health and '0' otherwise. Samples of children aged 6–14

show that 16.69 per cent of mothers have poor health, 14.69 per cent of fathers have poor health and 3.64 per cent of both mothers and fathers have poor health. Samples of children aged 15–24 show that 19.03 per cent of mothers have poor health, 15.91 per cent of fathers have poor health and 4.21 per cent of both mothers and fathers have poor health.

The IFLS measures unhealthy days as the number of days of primary daily activities that are missed due to poor health within the previous four weeks. The US CDC defines unhealthy days as the number of days during the previous 30 days in which the respondent felt that their physical or mental health was not good (CDC 2000). Based on their survey, adult respondents reported an average of 24.7 healthy days or 5.3 unhealthy days. This study defines parents as having poor health, specified as '1', if they reported at least five unhealthy days within the previous four weeks, and '0' otherwise. Based on this measurement of unhealthy days, the sample of children aged 6–14 shows that 12.14 per cent of mothers had at least 5 unhealthy days, 10.17 per cent of fathers had at least five unhealthy days and 1.78 per cent of both mothers and fathers had at least five unhealthy days. The sample of children aged 15–24 shows that 13.26 per cent of mothers had at least five unhealthy days, 11.02 per cent of fathers had at least five unhealthy days and 1.78 per cent of both mothers and fathers had at least five unhealthy days.

The third measure of parental health shocks is the incidence of acute morbidity symptoms. By using morbidity, I indirectly capture the possible psychological distress of parent illnesses, as respondents with a high level of psychological distress are more likely to record more symptoms (Kooiker 1995). The IFLS asks respondents about acute morbidity with the question: 'Did you have any symptoms of acute morbidity during the past 4 weeks?' The symptoms includes: headache, cough, and fever, difficulty in breathing, blood pressure, wound/injury, painful or swollen joints, diarrhoea and nausea /vomiting. A binary measure of self-reported morbidity symptoms is used to differentiate

between parents with poor health and good health. Based on the IFLS data, on average, adults reported three incidents of morbidity symptoms during the previous month. We identified parents as having poor health, specified as '1', if they reported at least five incidents of symptoms in the previous four weeks, and '0' otherwise. The sample of children aged 6–14 shows that 26.28 per cent of mothers had at least five incidents of symptoms, 24.79 per cent of fathers had at least five incidents of symptoms and 8.77 per cent of both mothers and fathers have at least five incidents of symptoms. The sample of children aged 15–24 shows that 27.07 per cent of mothers had at least five incidents of symptoms, 25.98 per cent of fathers had at least five incidents of symptoms and 9.35 per cent of both mothers and fathers had at least five incidents of symptoms.

To measure chronic health conditions and disabilities, we use limitations in ADL. The IFLS assesses physical functioning and asks whether respondents have the ability to do several daily activities such as carrying a heavy load; sweeping the house; walking five kilometres; bowing, squatting and/or kneeling; dressing without help; standing up from a chair; going to the bathroom without help; or standing up from a chair without help. We specified parents as having limitations in ADL if they reported having difficulties in at least three out of eight ADLs; we constructed these into a binary variable of '1' for poor health and '0' otherwise. Descriptive statistics of the sample of children aged 6–14 show that 4.69 per cent of mothers had at least three limitations in ADL, 3.25 per cent of fathers had at least three limitations in ADL and 0.49 per cent of both mothers and fathers had at least three limitations in ADL. The sample of children aged 15–24 shows that 5.28 per cent of mothers had at least three limitations in ADL, 3.79 per cent father had at least three limitations in ADL and 0.52 per cent of both mothers and fathers had at least three limitations in ADL.

Table 5.1: Health Shock Variables

Health Measures	Variables		Explanation
Self-rated health (SRH)	Mother poor health status (SRH)	1 = if mother reported her general health status as unhealthy and somewhat unhealthy	'In general, how is your health?' -Very healthy -Somewhat healthy -Somewhat unhealthy -Unhealthy
	Father poor health status (SRH)	1 = if father reported his general health status as unhealthy and somewhat unhealthy	
	Both mother and father poor health status (SRH)	1 = if both mother and father reported their general health status as unhealthy and somewhat unhealthy	
Activities of daily living (ADL)	Mother limitations in ADL	1 = if mother reported having at least 3 difficulties and/or being unable to carry on an ADL	ADL measures respondents' limitations across 8 functional activities: carrying a heavy load; sweeping the house; walking five kilometres; bowing, squatting and/or kneeling; dressing without help; standing up from a chair; going to the bathroom without help; or standing up from a chair without help.
	Father limitations in ADL	1 = if father reported having at least 3 difficulties or being unable to carry on an ADL	
	Both mother and father limitations in ADL	1 = if both mother and father reported having at least 3 difficulties or being unable to do ADL	
Unhealthy days	Mother unhealthy days	1 = if mother had at least 5 unhealthy days	'During the last 4 weeks, how many days of your primary daily activities did you miss due to poor health?'
	Father unhealthy days	1 = if father had at least 5 unhealthy days	
	Both mother and father unhealthy days	1 = if both mother and father have at least 5 unhealthy days	
Symptoms of acute morbidity	Mother high morbidity symptoms	1 = if mother had at least 5 incidents of morbidity symptoms in the last 4 weeks	'Did you have any symptoms of acute morbidity during the past 4 weeks such as: headache, cough, fever, difficulty in breathing, blood pressure, wound/ injury, painful or swollen joints, diarrhoea and nausea/vomiting'.
	Father high morbidity symptoms	1 = if father had at least 5 incidents of morbidity symptoms in the last 4 weeks	
	Both mother and father high morbidity symptoms	1 = if both mother and father had at least 5 incidents of morbidity symptoms in the last 4 weeks	

Source: IFLS 1997, 2000, 2007 & 2014

Table 5.2: Parental Health in the Estimation Sample

		Children aged 6–14	Children aged 15–24
Self-rated health	Mother (poor health)	16.69% (3459)	19.03% (1979)
	Father (poor health)	14.69% (2920)	15.91% (1588)
	Both parents (poor health)	3.64% (768)	4.21% (445)
Unhealthy days	Mother (poor health)	12.14% (2515)	13.26% (1379)
	Father (poor health)	10.17% (2020)	11.02% (1099)
	Both parents (poor health)	1.78% (376)	2.36% (250)
Symptoms of acute morbidity	Mother (poor health)	26.2% (5444)	27.07% (2814)
	Father (poor health)	24.7% (4927)	25.98% (2593)
	Both parents (poor health)	8.77% (1849)	9.35% (989)
Limitations in activities of daily living	Mother (poor health)	4.69% (845)	5.28% (519)
	Father (poor health)	3.25% (595)	3.79% (373)
	Both parent (poor health)	0.49% (96)	0.52% (54)

Source: IFLS 1997, 2000, 2007 & 2014

5.4.2 Children's Education Outcomes

Table 5.3 describes the school outcome variables used in this study. Based on the specification of both parental health shocks and children's educational outcomes, a sample of children were obtained; the sample is described in Table 5.4. There are more boys than girls in the younger group (6–14 years); however, a similar number come from both rural and urban areas. There are more boys than girls in the older group (15–24 years) and most children come from urban areas.

This study investigates several educational outcomes for both groups of children. In contrast to previous studies, I explore not only school attendance or enrolment but also the possibility of grade repetition as well as cognitive assessment to capture children's school attainment. Grade repetition is a widespread phenomena in most developing countries, including Indonesia. Grade repetition is non-negligible; therefore, failure to control this variable causes a substantial upward biases in estimated rates of return to schooling (Behrman & Deolalikar 1991). Socio-economic surveys report that grade repetition in elementary education academic year 2015/2016 is 4.64 per cent and that it is always higher in elementary education than in secondary junior and senior school (BPS 2016b)

We estimate three educational outcomes for children aged 6–14: 'hours in school' to capture school enrolment, and 'grade repetition' and 'cognitive assessment' to capture school attainment. In Indonesia, children start school at six years of age. Indonesia implemented a target of nine years of compulsory education, which consists of six years at elementary level for children aged 7–12 and three years of junior secondary school. The latest data shows that, in all provinces in Indonesia, the school participation rate for children aged 7–15 is more than 95 per cent; for children aged 7–12, the school participation rate is 99.09 per cent (BPS 2016b). We expect children in the age group 6–14 to be in school, either in primary or junior secondary school. However, as parents always tend to say that their children are in school (due to the government program), to capture the impact of parental health shocks on school enrolment, we use hours at school rather than in-school status.

Minimum hours of school are regulated under the ministry of education regulation *Keputusan Menteri Pendidikan Nasional Republik Indonesia No. 125/U/2002*. Children in Year 1 and 2 of elementary school should have at least 15 hours of school per week or

three hours per day; they should have five hours per day until Year 5 and about 6.5 hours for Year 6 and above. This minimum number of hours increases the higher the school grade.

Based on the sample obtained, 59.07 per cent children of aged 6–14 had less than 20 hours of school in the previous week, 13.58 per cent repeated a grade and 38.61 per cent had cognitive test score less than 10. These educational outcomes are described in Table 5.4.

Children aged 15–24 are expected to attend senior secondary school or higher education. Four outcome variables are estimated for children in this age group. 'In school' and 'work' to capture school enrolment, and 'grade repetition' and 'cognitive assessment' to capture school attainment. Official statistics show that, in 2016, 26.36 per cent of the population aged over 15 finished senior secondary school and 7.92 per cent finished university (BPS 2016b). Our sample shows that 49.05 per cent of children aged 15–24 attended school. For 27.82 per cent, working was their primary activity, 19.44 per cent had repeated a grade and 72.34 per cent had cognitive test scores less than 10. The cognitive assessment for children aged 6–14 had an average score of 10.97 with minimum score of 0 and maximum of 18. Children aged 15–24 had an average cognitive assessment test score of 8.126 with minimum score of 0 and maximum of 14.

Table 5.3: School Outcome Variables

Age group	Outcomes variables	Explanation
6–14 years	Hours in school	Total school hours attended in the last week (total hours per week)
	Grade repetition	'Did you ever repeat a grade at school?' 1 = yes; 0 = no
	Cognitive assessment	Total correct answers of cognitive test (IFLS administered cognitive tests to assess children's general cognitive level, as well as skills in mathematics)
15–24 years	In school	Attending school this year (yes/no)
	Work	Working as primary activity 1 = yes; 0 = no
	Grade repetition	'Did you ever repeat a grade at school?' 1 = yes; 0 = no
	Cognitive assessment	Total correct answers of cognitive test (IFLS administered cognitive tests to assess children's general cognitive level, as well as skills in mathematics)

Source: IFLS 1997, 2000, 2007 & 2014

Table 5.4: School Outcomes—Two Groups of Children

	Children aged 6–14 years		Children aged 15–24 years	
Number of children:		(%)		(%)
Panel year 1997	5312		2814	
Panel year 2000	5373		3181	
Panel year 2007	4879		2866	
Panel year 2014	5925		2401	
Age	6–10 years	55.68	15–19 years	78.08
	11–14 years	44.32	20–24 years	21.92
Sex	Girls	48.62		43.08
	Boys	51.37		56.91
Rural/urban	Rural	50.90		41.28
	Urban	49.10		58.72
Hours of school	< = 20 hours in a week	59.07		-
	> 20 hours in a week	40.92		-
In school	Attend	-		49.05
	Not attend	-		50.95
Working as primary activity	Yes	-	Yes	27.82
	No	-	No	72.18
Grade repetition	Yes	13.58		19.44
	No	86.42		80.56
Cognitive test	Score < = 10	38.61		72.34
	Score > 10	61.38		27.65

Source: IFLS 1997, 2000, 2007 & 2014

5.5 Methodology

Taking advantage of longitudinal data, this study uses the FE method to address unobserved heterogeneity at the individual level that may lead to a non-causal correlation between parental health shocks and children's outcomes. Using individual child-level FE, this study addresses the possibility that parents and children are shaped by common genetics and experiences that may affect both the probability of paternal health shocks and outcomes for children. Using child-level FE, this study controls for time-invariant unobserved characteristics, and the model includes several children, parental and household characteristics.

The FE method is able to control for unobserved time-invariant variables; however, a limitation of this strategy is that it does not control time-varying sources of endogeneity.

'The key insight is that if the unobserved variable does not change over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics' (Stock & Watson 2003, pp. 289–290). Time-varying unobservables that could affect parental health shocks and children's education are not taken into account with FE estimation (Evans & Miguel 2007). The FE model eliminates the influence of time-invariant unobservables, but time-varying unobservables affecting parental health shocks and children's schooling may still remain in the error term. These time-varying unobservables may create systematic biases that occur over time. Some other events might have occurred during the same period, such as parental job loss, crop failure and child morbidity, and these shocks could affect both parental health shocks and children's school outcomes.

To control for bias that comes from time-varying unobservables that might affect both children and the household, this study includes the variable 'life events'. 'Life events' include shocks such as death or sickness, crop loss or failure of family business, and losses caused by natural disasters that might affect both the health status of parents and children's school outcomes. To control for morbidity, children's SRH status is also included in the model.

Two specifications are applied in FE estimation:

$$Y_{ijt} = \alpha_0 + \alpha_1 PHS_{it} + +X'_{it}\alpha_2 + u_i + \varepsilon_{it} \quad (5.1)$$

$$Y_{ijt} = \alpha_0 + \alpha_{1.1} MHS_{it} + \alpha_{1.2} FHS_{it} + \alpha_{1.3} MFHS_{it} + X'_{it}\alpha_2 + u_i + \varepsilon_{it} \quad (5.2)$$

In the first specification (Model 1), the indicator of parental health shocks is captured by any shocks in either the mother or father and captured in one independent variable specified as parental health shocks and α_1 is the coefficient of interest. Y_{ijt}

represents measures of children's school enrolment and attainment outcome variables, and subscripts i, j and t denote individual, household and survey years. X'_{it} is the set of control variables and u_i represents time-invariant unobserved individual factors assumed to be correlated with the vector of explanatory variables; ε_{it} is a random time-varying error.

In the second specification (Model 2), we consider each individual parent health shock separately. Health shocks to mother (MHS), father (FHS) and both parents (MFHS) are included separately as regressors, since the three health indicators are mutually exclusive. The coefficients of interest are $\alpha_{1.1}\alpha_{1.2}\alpha_{1.3}$; they capture the impact of fathers', mothers' and both parents' health shocks on children's outcome variables. All health shock variables are specified as a binary variable equal to '1' if the mother of a child has a poor health status at the time *t* (MHS), a value of '1' if the father of a child has a poor health status at time *t* (FHS) and a value of '1' if both parents have a poor health status at time *t* (MFHS). Parental health shock specifications are described in Table 5.1.

Studies on school enrolment consider infrastructure, such as the availability or supply of a school, as a factor that determines school enrolment while allowing for possible rural and urban differentials. The supply of schools at the primary education level is not a serious concern in Indonesia (Nguyen & Purnamasari 2011); therefore, our study does not consider the possible difference estimation in rural and urban areas. Primary schools are available in every village in Indonesia; indeed, more than 95 per cent of villages in Java have a primary school as do more than 86.63 per cent of provinces outside Java Island. Junior and senior secondary schools are available at the district level. Further, more than 96.11 per cent of districts have both a junior and senior secondary school (BPS 2016a).

The independent variables used in our study are individual parental characteristics (such as age, work status and education level), household characteristics and children's characteristics. Parental age is expected to contribute differently to children's education in the event of shocks to a parent's health. Parental education and work status are expected to positively contribute to children's education. Among the household characteristics, household size reflects not only the number of living children but also the presence of other siblings to schooling of each children. Household assets capture household wealth and economic status. Having land is not included separately, as it is captured in household assets. Even though 32 per cent of the Indonesian population are without basic health insurance, we include the possibility of having health insurance as one of our covariates. Further, life events that have affected households and may cause economic hardships—such as crop losses or loss of a household business due to fire, earthquake or other disaster during the previous five years—are included as covariates to control for any other random shocks. Children's age and health are included as independent variables. Children's health status for the younger age group is drawn from Book-5 of the IFLS. SRH indicators are used to capture children's health status. Table 5.5 reports the descriptive statistics of all variables.

Table 5.5: Descriptive Statistics

	Children aged 6–14 Mean (SD)	Children aged 15–24 Mean (SD)
Outcome variables		
Hours in school (per week)	16.20 (11.39)	-
In school	-	0.490 (0.499)
Work for pay	-	0.278 (0.448)
Grade repetition	0.135 (0.342)	0.194 (0.395)
Cognitive assessment	10.97 (4.14)	8.126 (3.562)
Main independent variables:		
Mother poor health (SRH)	0.166 (0.372)	0.190 (0.392)
Father poor health (SRH)	0.146 (0.354)	0.159 (0.365)
Both parents poor health (SRH)	0.036 (0.187)	0.042 (0.200)
Mother unhealthy days	0.121 (0.326)	0.132 (0.339)
Father unhealthy days	0.101 (0.302)	0.110 (0.313)
Both parents unhealthy days	0.017 (0.132)	0.023 (0.151)
Mother limitations in ADL	0.046 (0.211)	0.037 (0.190)
Father limitations in ADL	0.032 (0.177)	0.052 (0.223)
Both parents limitations in ADL	0.004 (0.070)	0.005 (0.071)
Mother high morbidity symptoms	0.262 (0.440)	0.270 (0.444)
Father high morbidity symptoms	0.247 (0.431)	0.259 (0.438)
Both parents high morbidity symptoms	0.087 (0.282)	0.093 (0.291)
Independent variables:		
Age father	44.34 (9.95)	50.092 (8.029)
Age mother	39.27 (8.84)	44.649 (6.754)
Education father	8.23 (3.88)	8.044 (3.764)
Education mother	7.44 (3.90)	6.987 (3.692)
Work father	0.846 (0.360)	0.781 (0.413)
Work mother	0.456 (0.498)	0.461 (0.498)
Age of children	9.99 (2.57)	18.269 (2.490)
Health of children (1 = poor health)	0.069 (0.253)	0.081 (0.273)
Have health insurance	0.353 (0.478)	0.329 (0.470)
HH size	6.542 (2.486)	6.911 (2.422)
Log of HH assets	16.866 (1.848)	17.107 (1.753)
Life events	0.147 (0.355)	0.216 (0.411)

SRH = self-rated health; ADL = activities of daily living; HH = household.
Source: IFLS 1997, 2000, 2007 & 2014

5.6 Results and Discussion

The impact of parental health shocks on children's educational outcomes is determined by examining children's school enrolment as well as school attainment. The estimation for specification for both age groups are reported in Tables 5.6–5.9. The impact of any parental health shocks on children's educational outcomes as specified in Model 1 are presented in Tables 5.6 and 5.7. Tables 5.8 and 5.9 present the impact of individual parent health shocks as specified in Model 2. Estimation results based on gender for both age groups are reported in Tables 5.10–5.15. Estimation results using the pooled OLS method are also presented in each table.

5.6.1 The impact of parental health shocks on children's educational outcomes using model 1

Using the estimation specified in Model 1, Table 5.6 presents the impact of parental health shocks on a child's school enrolment for both age groups. To capture the school enrolment of this group, estimations use 'hours in school'. The FE shows that children aged 6–14 years have on average 4.27 fewer school hours if one parent experiences health shocks (the sample average of school hours for this age group is 16.2 hours per week). The pooled OLS estimations show that all parental health shocks negatively affect the number of hours that children attend school. Parental limitations in ADL produce significant estimations in both the pooled OLS and FE method.

To capture school enrolments for the older age group, we estimated the probability of being in education and the probability of working for pay. Estimates are presented in the right panel of Table 5.6. The FE method shows that children aged 15–24 are 5 per cent less likely to be in school if one parent reports poor health and 5.8 per cent less likely to be in school if one parent experiences health shocks as measured by limitations in ADL

(the sample average of students attending school for this age group is 49 per cent). Parental health shock indicators using SRH produce significant estimates in both the pooled OLS and FE method; limitations in ADL are only significant in the FE method.

Further, children in the older age group are 4.3 per cent more likely to work for pay if one parent experiences health shocks (the sample average of children working for pay is 27 per cent). Estimation using pooled OLS for children aged 15–24 years shows at least three parental health shock indicators that negatively affect children's school enrolment. All estimations using pooled OLS show significant estimates; however, only parental health shock measured by morbidity produces significant and similar estimates both in pooled OLS and FE methods.

Grade repetition and cognitive assessment are estimated to assess school attainment. Table 5.7 presents the impact of parental health shocks on school attainment for children from both age groups based on estimations specified in Model 1. Children in the 6–14 age group are more likely to repeat a grade at school and have a low cognitive assessment if either parent experiences health shocks. Children aged 6–14 are 1.9–2.2 per cent more likely to repeat a grade if one parent experiences poor health (the sample average of grade repetition of this age group is 13.5 per cent). Two indicators of parental health shocks significantly affect grade repetition in estimations using the FE method, and three indicators of parental health shocks significantly affect grade repetition in the pooled OLS method. Children aged 6–14 had a lower score in cognitive assessment (-0.77 points or 18.59 per cent of standard deviation) if one parent was in poor health due to morbidity. Parental health shocks measured by morbidity produced significant estimates using the FE method but were insignificant in pooled OLS.

Grade repetition and cognitive assessment estimations using Model 1 for children in the older age group are also reported in Table 5.7. Children aged between 15–24 are more likely to repeat a grade at school and to have a lower cognitive assessment score if either parent experiences health shocks. The FE estimation shows that children aged 15–24 are 5.38 per cent more likely to repeat a grade at school if one parent experiences health shocks measured by limitations in ADL (the sample average of grade repetition of this age group is 19.4 per cent). Children of this age group also had low cognitive assessment scores (-0.42 points or 11.79 per cent of standard deviation). The pooled OLS estimates show significant results for all parental health indicators. Health shocks significantly affect grade repetition and cognitive assessment of children aged 15–24.

5.6.2 The impact of parental health shocks on children's educational outcomes using model 2

Individual parent health shocks are estimated in more detail using Model 2. The results are presented in Tables 5.8 and 5.9. Table 5.8 presents the impact of health shocks experienced by fathers, mothers or both parents on children's school enrolment. Both maternal and paternal health shocks negatively affect the school hours of children aged between 6–14. On average, this younger age group attends 2.4–4.8 fewer hours at school due to maternal health shocks, and 2.4–9.9 fewer hours at school due to paternal health shocks (the sample average of school hours for this age group is 16.2 hours per week). The FE method identifies at least three health indicators that explain the negative impact that parental health shocks have on school enrolment for both age groups.

Both maternal and paternal health shocks negatively affect the probability that children aged 15–24 will be in school. Children in this group are 8.9 per cent less likely to attend school due to maternal health shocks and 4.7–6.7 per cent less likely to attend school due to paternal health shocks. The sample average of children in this age group

attending school is 49 per cent. Two parental health indicators produce significant estimates in both pooled OLS and FE methods; paternal health shocks (measured by SRH) and paternal morbidity result in children aged 15–24 being out of school. All four indicators of parental health shocks significantly explain this impact based on the FE method.

In Indonesia, mothers and fathers have a relatively equal position in household decision-making, including children's education. In a study of intra-household bargaining and children's education in Indonesia, Xu (2008) reported that maternal economic resources relative to paternal have significant positive effects on children's education in terms of expenditure, as well as mathematic and cognitive performance. The active role of the mother in Indonesia has also been reported by Nobles and Frankenberg (2009). They found that a mother's access to social capital via participation in community activities significantly improved her children's health, and that this was especially significant for the mothers of families with relatively low levels of human and financial capital. Mother's greater bargaining power also has a positive effect on children's nutritional status and school expenditure (Park 2007). However, maternal orphans have more educational outcomes compared to non-orphans (Suryadarma, Pakpahan & Suryahadi 2009).

Table 5.8 reports the impact of parental health shocks on the probability of children working for pay. Estimation results point to the significance of paternal health shocks. Using the FE method, children in the older group are 6–13 per cent more likely to work for pay if fathers experience health shocks (as determined by the presence of three health indicators). The sample average of children working is 27 per cent.

Table 5.9 reports the impact of health shocks experienced by fathers, mothers or both parents on children's school attainment. Children aged 6–14 years are 17.14 per cent more likely to repeat a grade if both parents experience poor health as measured by limitations in ADL. This group of children also have a lower cognitive assessment score if mothers experience poor health (–0.8 to –1.19 lower or 22.45–33.40 per cent of standard deviation). Mothers' health shocks, as measured by SRH and unhealthy days, show significant effects on grade repetition using the pooled OLS method but insignificant results using the FE method. Mothers' health shocks, as measured by SRH and morbidity, show consistent estimates on the cognitive assessment of children aged 6–14 both in pooled OLS and FE methods.

Few children aged 15–24 reported grade repetition. Although the probability is lower compared to the younger age group, children aged between 15–24 are 8 per cent more likely to experience grade repetition if mothers experience health shocks (the sample average of grade repetition of this age group is 19.4 per cent). This finding is in line with an OECD report, which states that Indonesia is one of 14 non-OECD countries in which more than 10 per cent of 15-year-old students have repeated a grade, and that students in Indonesia are more likely to repeat a grade at the level of primary education compared with secondary education (Ikeda & García 2014). Estimation using the pooled OLS method shows that children in the older age group also had a lower cognitive assessment score, which was explained by all four health indicators; however, no significant result was found using the FE method. Low variability within children could be the reason for this result.

5.6.3 The impact of parental health shocks on children's educational outcomes by gender

Possible gender differences in children's school outcomes are estimated and presented in Tables 5.10–5.15. Tables 5.10 and 5.11 report the impact of parental health shocks on children's school enrolment for both age groups by gender. Tables 5.12–5.15 report the impact of parental health shocks on children's school attainment for both age groups by gender.

Table 5.10 reports the impact of any parental health shock on school enrolment by gender for both age groups using Model 1. All four parental health shock indicators show that parental health shocks negatively affect boys' hours of school using the pooled OLS method; however, low variability among boys resulted in no significant estimates when using the FE method. On the other hand, FE results show that girls aged 6–14 had fewer hours at school due to parental health shocks based;

When I analysed the impact of parental health shocks (measured through limitations in ADL) on children's school enrolment (hours in school) for children aged 6–14 (Tables 5.6 and 5.8), results from the FE estimation were substantially higher than those from the OLS estimation. The estimation results from the FE method show that parental health shocks, particularly parental ADL limitations, have a greater negative impact on the school enrolment of children aged 6–14 than children aged 15–24. This impact is even greater on girls aged 6–14 (Table 5.10). ADL measures both chronic health conditions and disabilities, as it assesses physical functioning. Parental health shocks due to limitations in physical functioning have a significant impact on children's school enrolment, particularly the number of hours in school, because children are forced to stay at home, either to help with domestic activities or because parents are unable to take them to school. The reason for the difference between the OLS and FE results are unclear;

however, the estimates overall show that parental health has a very strong impact on children's education, even when we take into account unobserved characteristics that do not vary over time.

Boys and girls the 15–24 age group are less likely to attend school due to parental health shocks. Boys are 4–8 per cent less likely to attend school while girls are 5.8–7.5 per cent less likely to attend school. Parental health shocks significantly affect boys in this age group in terms of working for pay. Boys are 7 per cent more likely to work for pay compared to girls if parents experience health shocks.

Table 5.11 reports the impact of individual parental health shocks on school enrolment by gender for both age groups using Model 2. Using morbidity as a health indicator, the Model 2 estimations show similar results to Model 1. Parental health shocks significantly affect girls aged 6–14, but not boys. Girls in the 6–14 age group have 2.89 fewer hours of school if fathers experience health shocks.

Changes in household economic resources affect the wellbeing and outcomes of girls relative to boys. This is consistent with reports on education in Uganda (Björkman-Nyqvist 2013), child mortality (Rose 1999) and stress and psychosocial adjustment problems due to parental illness (Sieh et al. 2012).

Table 5.11 shows that girls in the 15–24 year-old age group are 11.5 per cent less likely to attend school if they have a sick parent. These findings are in line with the data reported in 2016 Socio-Economic Survey. This found that the average years of schooling for girls aged over 15 years is lower than for boys, both in urban and rural areas. The percentage of girls aged over 15 who finish senior secondary school is 23.58; by contrast, 29.14 per cent of boys aged over 15 finish school (BPS 2016b). In Indonesia, girls have a lower likelihood of continuing junior secondary school compared to boys (Suryadarma,

Suryahadi & Sumarto 2006); male children have a higher probability of being enrolled at secondary level and the level of educational expenditure is also higher for males (Alisjahbana 1999).

Estimations using Model 2 show that parental health shocks significantly affect boys more than girls in term of work for pay. Boys in the 15–24 year-old age group are 11.87 per cent more likely to work if fathers experience health shocks, and girls are 13.97 per cent less likely to work for pay if both parents experience health shocks. Parental health shocks might result in boys working for pay; however, girls might be required for domestic work, particularly when both parents experience health shocks. National statistics show that, among students aged 10–24, 8.28 per cent of boys and 6.58 per cent of girls work (BPS 2016b). In Indonesia, girls learn from an early age to become caretakers and homemakers (Mulatsih 1994) while boys are expected to undertake market-oriented work. Although the gender gap in schooling is not significant at elementary school, it is apparent that boys spend more time in market work while girls spend more time in non-market work (Hsin 2007).

Tables 5.12 and 5.13 report the impact of parental health shocks on children's school attainment for children aged 6–14 by gender for both models. Table 5.12 reports the estimation using Model 1 and shows that parental health shocks negatively affect grade repetition for both boys and girls. Estimations using Model 1 show that boys are 3 per cent more likely to repeat a grade due to parental health shocks, and girls are 5.2 per cent more likely to repeat a grade due to parental health shocks. Parental health shocks also affect cognitive assessment scores for boys and girls. On average, all children lose 1 point (equivalent to 24.15 per cent of standard deviation) in their cognitive assessment scores when they have a sick parent.

Table 5.13 reports estimations using Model 2 and shows that health shocks to mothers significantly affect girls' grade repetition and cognitive assessment scores. Girls are 3.7 per cent more likely to repeat a grade if mothers experience health shocks; however, there is no evidence on boys' grade repetition. Maternal health shocks affect girls' cognitive assessment scores more than boys. Girls' cognitive assessment scores are reduced by 1.03 if mothers experience health shocks.

Tables 5.14 and 5.15 report the impact of any parental health shocks on school attainment for children aged 6–24 years by gender. Estimations using Model 1 are reported in Table 5.14. These show that parental health shocks significantly affect boys' cognitive assessment; however, there is no significant evidence on grade repetition for this age group. Table 5.15 shows that paternal health shocks are more likely to affect girls' grade repetition and cognitive assessment for children aged 15–24 based on the pooled OLS method; however, there is no significant evidence using the FE method.

5.7 Conclusion

Parents' socio-economic resources, level of engagement and availability contribute to children's outcomes over the course of their life. The consequences of parental illness are different to other family disruptions—they increase medical expenditure and place constraints on the time of healthy family members for the duration of the illness. Indonesia has improved its access to education and has implemented nine years of compulsory education; however, this developing country faces complex disease epidemiology patterns and limited access to formal health insurance, credit markets and medical facilities. This study has investigated the impact of parental health shock on several school outcomes for children.

Using a rich data set comprising an ongoing longitudinal survey, this study investigated the impact of parental health shocks on children's school outcomes. Several measures of parental health status were used to capture parental health shocks: 1) SRH status; 2) limitations to ADL, which captures chronic health conditions and disabilities; 3) acute morbidity symptoms, which indirectly captures possible psychological distress; and 4) number of unhealthy days, which captures the impact of poor health on primary daily activities. This study analysed children's school outcomes and investigated both school enrolment and school attainment for two groups of children.

Two specification were used. Parental health shocks as measured by any shocks to either parent were captured in one independent variable in Model 1. In Model 2, each individual parent health shock was estimated separately. Mothers' health shocks, fathers' health shocks and both parents' health shocks were included separately as regressors since the three health indicators are mutually exclusive.

Both school enrolment and school attainment were estimated. Grade repetition and cognitive assessment were used to capture school attainment. The number of 'hours in school' within the previous week was used to investigate school enrolment for children in the younger age group. School attendance and working for pay were estimated for children in the older age group to capture school enrolment. Grade repetition and cognitive assessment scores were estimated to capture cognitive assessment.

Using panel data that spans a period of 17 years and making estimates using child FE, the results illustrate that parental health shocks have a negative impact on children's school outcomes. Parental health shocks for either mothers or fathers, as specified in estimation Model 1, negatively affect school enrolment and school attainment for both age groups. Children aged 6–14 attend school for fewer hours, are more likely to repeat

a grade and have lower cognitive assessment scores due to parental health shocks. Children aged 15–24 are less likely to attend school, more likely to work for pay, more likely to repeat a grade and have lower cognitive assessment scores if either parent experiences health shocks. All four indicators of parental health shocks show significant results based on the pooled OLS method, and at least one indicator of parental health shocks significantly affects children's school enrolment and attainment based on the FE method.

Individual parental health shocks in mothers, fathers or both parents, as specified in Model 2, reported similar estimation result. For children aged 6–14, health shocks in mothers and fathers significantly effected hours of school and grade repetition; however, only health shocks in mothers effected cognitive assessment. For children aged 15–24 years, health shocks for mothers and fathers resulted in children being out of school; however, only health shocks in fathers resulted in children working for money, while health shocks in mothers were more likely to affect grade repetition.

Estimation results by gender show that, among children aged 6–14 years, parental health shocks are more likely to affect girls' hours of school compared to boys; however, among 15–24 year-olds, both girls and boys are less likely to be in school due to parental health shocks. Estimations on the possibility of working for pay show that boys aged 15–24 years are more likely to work if fathers experience health shocks while girls are less likely to work if both parents experience health shocks.

In children aged 6–14 years, parental health shocks negatively affect boys' and girls' grade repetition and cognitive assessment; however, for children aged 15–24, parental health shocks significantly affect boys' cognitive assessment.

Gender differential estimations, particularly on school enrolment, show that parental health shocks are more likely to affect girls than boys the higher the school level and the older the age group. Parental health shocks are more likely to result in boys working for pay.

Girls aged 6–14 attend fewer hours of school due to parental health shocks. Girls aged 15–24 are less likely to be in school if fathers experience health shocks; however, these girls do not take up paid work. Boys are more likely to work if fathers experience health shocks; girls are less likely to work if both mothers and fathers experience health shocks.

The findings of this study point to important policy implications. Equal access to education for girls and boys (particularly in secondary school) and better access to health care and medical facilities will help broader investments already made in children's human capital.

Table 5.6: Parental Health Shocks and Children's School Enrolment

	Children aged 6–14 years		Children aged 15–24 years			
	Hours in school		In school		Work	
Dependent variables	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**
Parent poor health (SRH)	**-0.4664*** **	-1.2849	**-0.0343*** **	**-0.05007** **	**0.0270*** **	-0.0021
	(0.1734)	(0.8611)	**(0.0095)**	**(0.0214)**	**(0.0094)**	(0.0216)
Parent had ≥ 5 unhealthy days	**-0.5861*** **	0.9856	**-0.0202** **	-.031079	**0.0354*** **	0.0245
	(0.1900)	(0.8736)	**(0.0105)**	(0.02164)	**(0.0105)**	(0.0229)
Parent had ≥ 5 incidents of morbidity symptoms	**-0.6892*** **	-1.2017	**-0.0241*** **	-0.0284	**0.0294*** **	**0.0437** **
	(0.1506)	(0.7738)	**(0.0087)**	(0.0201)	**(0.0085)**	**(0.0196)**
Parent had ≥ 3 limitations in ADL	**-0.8404*** **	**-4.2714** **	-0.01334	**-0.0581***	**0.0466*** **	0.01834
	(0.3069)	**(1.7028)**	(0.0161)	**(0.0361)**	**(0.0169)**	(0.0384)
N (maximum number of observations in estimation)	14,324	14,324	10,513	10,513	10,513	10,513

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.7: Parental Health Shocks and Children's School Attainment

	Children aged 6–14 years				Children aged 15–24 years			
	Grade repetition		Cognitive assessment		Grade repetition		Cognitive assessment	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Parent poor health (SRH)	**0.0178*** ** (0.0056)**	**0.0223** ** (0.0115)**	**-0.1431** ** (0.0691)**	-0.1337 (0.3110)	**0.0168* (0.0092)**	-0.0427 (0.0189)	**-0.4089*** ** (0.0768)**	**-0.4228* (0.2377)**
Parent had ≥ 5 unhealthy days	**0.0165*** ** (0.0062)**	**0.0190* (0.0108)**	**-0.1556** ** (0.0768)**	-0.3030 (0.3281)	**0.0258*** ** (0.010)**	-0.0311 (0.0213)	**-0.1582* (0.0840)**	-0.0603 (0.2533)
Parent had ≥ 5 incidents of morbidity symptoms	**0.0100** ** (0.0050)**	0.0079 (0.0089)	-0.1000 (0.0647)	**-0.7758*** ** (0.2907)**	**0.0143* (0.0084)**	-0.010 (0.0192)	**-0.1279* (0.0724)**	-0.1445 (0.2251)
Parent had ≥ 3 limitations in ADL	0.0030 (0.0103)	0.0344 (0.0232)	0.0158 (0.1251)	-0.1402 (0.6991)	**0.0468*** ** (0.0166)**	**0.0538* (0.0329)**	**-0.3961*** ** (0.1292)**	0.19041 (0.4124)
N (maximum number of observations in estimation)	19,689	19,689	13,951	13,951	9,156	9,156	7,771	7,771

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.8: Individual Parental Health Shocks and Children's School Enrolment

	Children aged 6–14 years		Children aged 15–24 years			
	Hours in school		In school		Work	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Mother poor health (SRH)	-0.1595	**-2.417****	**-0.0287****	-0.0278	**0.0293****	-0.0046
	(0.2402)	**(1.160)**	**(0.0128)**	(0.0292)	**(0.0128)**	(0.0292)
Father poor health (SRH)	**-0.6968*****	-0.7957	**-0.0279****	**-0.0658****	0.0052	0.0257
	(0.2606)	(1.2872)	**(0.0143)**	**(0.033)**	(0.0145)	(0.0340)
Both parents poor health (SRH)	-0.2867	1.0640	0.0109	0.0235	0.0129	-0.0406
	(0.5121)	(2.2806)	(0.0274)	(0.0606)	(0.0280)	(0.0600)
Mother had ≥ 5 unhealthy days	**-0.5423****	1.1108	-0.0200	0.0075	**0.0292****	-0.0256
	(0.2587)	(1.1153)	(0.0146)	(0.0297)	**(0.0144)**	(0.0314)
Father had ≥ 5 unhealthy days	**-0.7981*****	-0.5204	-0.0186	**-0.0678****	0.0244	**0.0634***
	(0.2903)	(1.289)	(0.0162)	**(0.0334)**	(0.0165)	**(0.0363)**
Both parents had ≥ 5 unhealthy days	**2.0530*****	1.6642	0.0313	-0.0484	-0.0021	0.0385
	(0.6740)	(2.7734)	(0.0346)	(0.0631)	(0.0353)	(0.0735)
Mother had ≥ 5 incidents of morbidity symptoms	-0.2694	-0.7318	-0.0190	-0.0309	**0.0281 ****	0.0413
	(0.2103)	(1.0151)	(0.0122)	(0.0275)	**(0.0121)**	(0.0279)
Father had ≥ 5 incidents of morbidity symptoms	**-0.9326*****	**-2.483 ****	**-0.0272****	**-0.0473***	**0.0329*****	**0.0802*****
	(0.2233)	**(1.1943)**	**(0.0128)**	**(0.0293)**	**(0.0126)**	**(0.0278)**
Both parents had ≥ 5 incidents of morbidity symptoms	-0.00007	1.4570	0.0224	0.0404	-0.0468	-0.1262
	(0.3670)	(1.8442)	(0.0217)	(0.0459)	(0.0217)	(0.0456)
Mother had ≥ 3 limitations in ADL	**-0.9276****	**-4.8540 ****	-0.01569	**-0.0898***	**0.0712*****	-0.0259
	(0.4168)	**(2.2267)**	(0.0218)	**(0.0513)**	**(0.0227)**	(0.0550)
Father had ≥ 3 limitations in ADL	-0.6333	**-9.9400*****	0.0010	-0.0446	0.0039	**0.1367****
	(0.4919)	**(2.2241)**	(0.0261)	(0.0670)	(0.0273)	**(0.0708)**
Both parent had ≥ 3 limitations in ADL	0.2503	6.7029	0.0150	0.0486	-0.0244	0.1274
	(1.1719)	(4.8412)	(0.0624)	(0.1598)	(0.0753)	(0.1934)
N (maximum number of observations in estimation)	13,292	13,292	9,772	9,772	9,772	9,772

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.9: Individual Parental Health Shocks and Children's School Attainment

	Children aged 6–14				Children aged 15–24			
	Grade repetition		Cognitive assessment		Grade repetition		Cognitive assessment	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Mother poor health (SRH)	**0.0162****	0.0182	**-0.1608***	**-0.8331****	0.0132	-0.0386	**-0.235****	0.0271
	(0.0075)	(0.0160)	**(0.0927)**	**(0.3794)**	(0.0123)	(0.0255)	**(0.1001)**	(0.2949)
Father poor health (SRH)	0.0114	0.0090	**-0.1160**	0.8478	0.0198	-0.0349	**-0.5825*****	-0.4393
	(0.0086)	(0.0165)	**(0.1001)**	(0.4868)	(0.0143)	(0.0296)	**(0.1166)**	(0.3888)
Both parents poor health (SRH)	0.0141	0.0509	0.0211	-0.7023	0.0063	0.0482	-0.0397	-0.5340
	(0.0175)	(0.0377)	(0.2042)	(0.8588)	(0.0278)	(0.055)	(0.2169)	(0.6567)
Mother had ≥ 5 unhealthy days	**0.0185****	0.0018	-0.1141	-0.2939	**0.0321****	-0.0323	-0.1031	-0.2607
	(0.0084)	(0.0162)	(0.1010)	(0.4696)	**(0.0142)**	(0.0288)	(0.1150)	(0.3542)
Father had ≥ 5 unhealthy days	0.0063	0.0202	**-0.2021***	-0.2229	**0.0295***	-0.0399	**-0.3310*****	0.2113
	(0.0094)	(0.0159)	**(0.1159)**	(0.5008)	**(0.0161)**	(0.0331)	**(0.1243)**	(0.3667)
Both parents had ≥ 5 unhealthy days	-0.0077	0.0006	-0.1950	-0.2398	-0.0407	0.02014	0.3075	-0.2988
	(0.0220)	(0.0444)	(0.2782)	(0.9361)	(0.0345)	(0.0833)	(0.2658)	(0.8233)
Mother had ≥ 5 incidents of morbidity symptoms	0.0076	0.0085	**-0.1734****	**-1.1913*****	0.0139	-0.0016	-0.0752	0.0844
	(0.0069)	(0.0131)	**(0.0875)**	**(0.3802)**	(0.0118)	(0.0271)	(0.1007)	(0.3246)
Father had ≥ 5 incidents of morbidity symptoms	0.0101	0.0085	-0.0336	-0.1168	0.01365	-0.0109	**-0.1679***	0.145
	(0.0072)	(0.0133)	(0.0913)	(0.4487)	(0.0123)	(0.0265)	**(0.1025)**	(0.2845)
Both parents had ≥5 incidents of morbidity symptoms	-0.0081	-0.0202	-0.0572	0.5412	-0.0047	-0.0175	-0.0553	-0.7049
	(0.0126)	(0.0225)	(0.1608)	(0.7083)	(0.0213)	(0.0446)	(0.1824)	(0.5741)
Mother had ≥ 3 limitations in ADL	-0.0038	0.0565	-0.1232	-0.3583	0.03447	**0.0802****	**-0.5314****	0.2759
	(0.0128)	(0.0397)	(0.1601)	(1.0700)	(0.0216)	**(0.0417)**	**(0.2223)**	(0.5841)
Father had ≥ 3 limitations in ADL	0.0122	0.0531	0.1170	2.0060	0.0335	0.0636	**-0.3529****	0.0880
	(0.0185)	(0.0460)	(0.2017)	(1.4799)	(0.0270)	(0.066)	**(0.1649)**	(0.5904)
Both parents had ≥ 3 limitations in ADL	-0.0281	**0.1714*****	0.6899	-1.8722	**0.1426***	0.1474	-0.2430	1.041972
	(0.0391)	**(0.0618)**	(0.4944)	(2.3067)	**(0.0795)**	(0.2135)	(0.4648)	(1.855)
N (maximum number of observations in estimation)	18,343	18,343	13,160	13,160	8,616	8,616	7,319	7,319

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.10: Parental Health Shocks and Children's School Enrolment by Sex

	Children aged 6–14				Children aged 15–24							
	Hours in school				In school				Work			
	Boys		Girls		Boys		Girls		Boys		Girls	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Parent poor health (SRH)	**-0.6339*** (0.2420)**	-1.0657 (1.1145)	-0.3072 (0.2483)	-1.1430 (1.3381)	**-0.0460*** (0.0123)**	**-0.0449* (0.0269)**	-0.0136 (0.0149)	-0.0547 (0.0353)	**0.0421*** (0.0127)**	0.0162 (0.0293)	0.0015 (0.0137)	-0.0343 (0.0315)
Parent had ≥ 5 unhealthy days	**-0.7977*** (0.2608)**	1.748 (1.1929)	-0.3682 (0.2772)	-0.0870 (1.3030)	-0.0158 (0.0136)	-0.0092 (0.0280)	-0.0253 (0.0165)	**-0.0588* (0.0336)**	**0.0442*** (0.01420)**	0.0256 (0.0299)	0.0236 (0.0152)	0.0211 (0.0353)
Parent had ≥5 incidents of morbidity symptoms	**-0.8293*** (0.2084)**	-1.0480 (1.0816)	**-0.5317** (0.2178)**	-1.3424 (1.0873)	**-0.0194* (0.0115)**	0.0023 (0.0261)	**-0.0303** (0.0135)**	**-0.0755** (0.0316)**	**0.0344*** (0.0117)**	**0.0735*** (0.0258)**	**0.0222* (0.0123)**	-0.0025 (0.0303)
Parent had ≥3 limitations in ADL	**-0.7720* (0.4332)**	-3.4392 (2.2454)	**-0.9010** (0.4341)**	**-5.2352** (2.6361)**	-0.0224 (0.0203)	**-0.0880** (0.0435)**	0.0070 (0.0263)	0.0236 (0.0631)	**0.0505** (0.0221)**	0.0284 (0.0471)	0.0368 (0.0258)	-0.0152 (0.0672)
N (maximum number of observations in estimation)	7,343	7,343	6981	6,009	6,009	6,009	4,504	4,504	6,009	6,009	4,504	4,504

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.11: Individual Parental Health Shocks and Children's School Enrolment by Sex

	Children aged 6–14				Children aged 15–24							
	Hours in school				In school				Work			
	Boys		Girls		Boys		Girls		Boys		Girls	
Dependent variables	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**
Mother had ≥ 5 incidents of morbidity symptoms	**-0.4682* (0.2884)**	-0.8593 (1.3939)	-0.0630 (0.3070)	-0.0827 (1.5253)	-0.0178 (0.0158)	-0.0102 (0.0345)	-0.0180 (0.0191)	-0.0677 (0.0451)	**0.0265* (0.0164)**	0.0488 (0.0358)	0.0279 (0.0179)	0.0170 (0.0412)
Father had ≥ 5 incidents of morbidity symptoms	**-1.0424*** (0.3138)**	-1.9616 (1.7545)	**-0.8035*** (0.3186)**	**-2.899* (1.5690)**	-0.0200 (0.0165)	0.0013 (0.0380)	**-0.0383* (0.0201)**	**-0.115*** (0.04614)**	**0.0392** (0.0170)**	**0.1187*** (0.0371)**	0.0245 (0.0185)	0.0377 (0.0451)
Both parent had ≥ 5 incidents of morbidity symptoms	0.5370 (0.5070)	1.9710 (2.479)	-0.5547 (0.5328)	-0.3208 (2.7909)	0.0218 (0.0279)	-0.0332 (0.0598)	0.0216 (0.0343)	0.1535 (0.0710)	-0.0323 (0.0295)	-0.1229 (0.0598)	**-0.0649** (0.0311)**	**-0.1397** (0.0710)**
N	6,831	6,832	6,456	6,456	5,611	5,611	4,157	4,157	5,611	5,611	4,157	4,157

Note: * Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.12: Parental Health Shocks and School Attainment in Children Aged 6–14 Years by Sex

	Grade repetition				Cognitive assessment			
	Boys		Girls		Boys		Girls	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Parent poor health (SRH)	**0.0194****	0.0217	**0.0167****	0.0211	-0.1395	-0.0861	-0.1511	-0.1814
	(0.0085)	(0.0176)	**(0.0073)**	(0.0147)	(0.0995)	(0.4460)	(0.0960)	.4155477
Parent had ≥ 5 unhealthy days	**0.0193****	**0.0306***	**0.0149***	0.0079	-0.1107	-0.1382	**-0.1892***	-0.617
	(0.0093)	**(0.0173)**	**(0.0081)**	(0.0128)	(0.1097)	(0.4384)	**(0.1072)**	(0.476)
Parent had ≥ 5 incidents of morbidity symptoms	**0.0171****	0.0003	0.0037	0.0165	**-0.2117****	**-0.7604***	0.0188	**-0.7849****
	(0.0075)	(0.0141)	(0.0065)	(0.010)	**(0.0925)**	**(0.4213)**	(0.0904)	**(0.3961)**
Parent had ≥ 3 limitations in ADL	0.0019	0.0201	0.0057	**0.0521***	**-0.0556**	-0.3953	0.0834	1.2551
	(0.0158)	(0.0343)	(0.0132)	**(0.0282)**	**(0.1775)**	(0.8868)	(0.1761)	(1.0815)
N (maximum number of observations in estimation)	10,088	10,088	9,602	9,602	7,197	7,197	6,754	6,754

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.13: Individual Parental Health Shocks and School Attainment in Children Aged 6–14 Years by Sex

	Grade repetition				Cognitive assessment			
	Boys		Girls		Boys		Girls	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Mother poor health (SRH)	**0.0238****	-0.0033	0.0082	**0.0376***	-0.2026	-0.7137	-0.1268	**-1.0316***
	(0.0116)	(0.0248)	(0.0095)	**(0.0199)**	(0.1342)	(0.5136)	(0.1276)	**(0.5489)**
Father poor health (SRH)	0.0068	0.0244	0.0168	-0.0107	-0.1037	1.120312	-0.1288	0.8171
	(0.0128)	(0.0234)	(0.0112)	(0.0227)	(0.1426)	(0.7450)	(0.1405)	(0.6233)
Both parents poor health (SRH)	0.0113	0.0580	0.0163	0.0481	0.0648	-1.1747	-0.0227	-0.5867
	(0.0260)	(0.0545)	(0.0230)	(0.0517)	(0.2949)	(1.3099)	(0.2826)	(1.1316)
N (maximum number of observations in estimation)	9,428	9,428	8,916	8,916	6,810	6,810	6,350	6,350

Note: SRH = self-rated health.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.14: Parental Health Shocks and School Attainment in Children Aged 15–24 Years by Sex

	Grade repetition				Cognitive assessment			
	Boys		Girls		Boys		Girls	
Dependent variables	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE
Parent poor health (SRH)	0.0081	-0.0205	**0.02194***	-0.0675	**-0.4264*****	**-0.6780****	0.0015	-0.03431
	(0.0131)	(0.0248)	**(0.0126)**	(0.02938)	**(0.1005)**	**(0.2948)**	(0.0137)	(0.0315)
Parent had ≥ 5 unhealthy days	0.0143	-0.04463	**0.0390*****	-0.0038	-0.1755	0.2608	0.0236	0.0211
	(0.0145)	(0.0312)	**(0.0143)**	(0.0275)	(0.1106)	(0.3188)	(0.0152)	(0.0353)
Parent had ≥ 5 incidents of morbidity symptoms	0.0074	-0.0080	**0.0222****	-0.0077	-0.0427	-0.0511	**0.0222***	-0.0025
	(0.0121)	(0.0273)	**(0.0111)**	(0.0254)	(0.0959)	(0.2714)	**(0.0123)**	(0.0303)
Parents had ≥ 3 limitations in ADL	**0.0449****	0.0601	**0.0450****	0.0315	**-0.4065*****	0.4223	0.0368	-0.0152
	(0.0228)	(0.0418)	**(0.0234)**	(0.0524)	**(0.1655)**	(0.4819)	(0.0258)	(0.0672)
N (maximum number of observations in estimation)	5119	5119	4,037	4,037	4,466	4,466	3,305	3,305

Note: SRH = self-rated health; ADL = activities of daily life.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

Table 5.15: Individual Parental Health Shocks and School Attainment in Children Aged 15–24 Years by Sex

	Grade repetition				Cognitive assessment			
	Boys		Girls		Boys		Girls	
Dependent variables	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**
Mother poor health (SRH)	0.0139 (0.0174)	-0.0075 (0.0326)	0.0046 (0.0165)	0.0909 (0.0417)	**-0.2408* (0.1308)**	-0.2534 (0.3657)	-0.2073 (0.1542)	0.7508 (0.4980)
Father poor health (SRH)	0.0139 (0.0174)	-0.0108 (0.0390)	**0.04496** **(0.0207)**	-0.0591 (0.0439)	**-0.5695*** **(0.15027)**	-0.4540 (0.4467)	**-0.5739*** **(0.1855)**	0.0090 (0.7691)
Both parents poor health (SRH)	0.0264 (0.0383)	0.0001 (0.0696)	-0.0171 (0.0387)	0.11896 (0.0879)	-0.1480 (0.2855)	-0.5450 (0.76510)	0.1025 (0.3318)	-0.9051 (1.2931)
N (maximum number of observations in estimation)	4,851	4,851	3,765	3,765	4,220	4,220	3,099	3,099

Note: SRH = self-rated health.
* Indicates that the underlying coefficient is significant at the 10% level, ** at 5% and *** at 1%.

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Chapter 6: General Conclusion

This thesis includes three essays that investigate migration, household consumption, health and education. The first two essays analyse the impact of migration on households' outcomes, focusing on consumption and health; the third essay examines the relationship between the health of parents and children's school outcomes.

Migration is a family strategy that brings many benefits and drawbacks consequences to the livelihood of migrants at their new destinations and MSHs back at home. This thesis focuses on the impact of migration on the wellbeing of the family left behind. The positive impact of migration for MSHs relates to the increase in family income. Remittance promotes productive investment in physical and human capital in MSHs. The negative impact of migration relates to the potential losses of income and family disruption associated with migrants' absences.

The first essay in this thesis investigates the impact of migration on food expenditure and the food security status of MSHs in the less-developed part of eastern Indonesia. The findings in this paper point towards migration having positive outcomes and increasing food expenditure and the total expenditure of MSHs. Migration not only increases household food expenditure but also food security status. This can be translated into the view that migration helps MSHs in terms of affordability and vulnerability to food price shocks. Further, migration also results in an increase in the diversity of food, despite the fact that migration also creates poorer diet habits.

The findings from the first essay contribute to the limited number of studies that have been produced on eastern Indonesia, a region in which 79 out of 100 districts are categorised as most vulnerable to food insecurity. The first essay helps to form a better

understanding of the issues that should be considered in designing and implementing policies to maximise the benefits of migration and to minimise the associated costs. Based on the positive outcomes of migration on migrant sending household in eastern part of Indonesia, the government should continue the to set the decentralizes services in all other provinces in Eastern part of Indonesia in order to maximize the short- and long-run benefits from the use of remittances to households, communities, and the economy.

The second essay investigates the monetary and non-monetary side of migration by focusing on the impact of adult child migration on the health of parents left behind. Most developing countries focus on maternal and child health as health policy priorities. Consequently, there is a lack of evidence on the health of ageing individuals, particularly in Indonesia. The second essay explores several parental health indicators and investigates several groups, including migrant sons, migrant daughters, parents aged over 50 and parents in rural areas.

The results show that the out-migration of adult children has a positive and significant association with the health status of parents left behind. Transmission channels show that households with at least one migrant child have significantly more per capita total expenditure. An increase in a household's per capita total expenditure leads to better food consumption, better access to health care and preventive care (such as medical and nutritional input), resulting in a better health status for the parents left behind. The findings of this study are consistent with the view that migration increases family resources and contributes to better health care for the family left behind.

Focusing on parental health, the third essay examines the relationship between parental health shocks and children's school outcomes. Rather than the absence of parents, the third essay investigates the consequences of parental illness, which are

different from any other source of family disruption (e.g., parental absence due to migration). Parental illness increases medical expenditure and places constraints on the time of other healthy family members, which can negatively affect investment in children's human capital, particularly education. Several measures of parental health status are used to capture parental health shocks: SRH status, limitations on ADL, incidence of acute morbidity symptoms and unhealthy days. These measures are used to investigate the impact of parental health shocks on children's school outcomes, both in terms of school enrolment and school attainment. The third essay investigates children and adolescents and also analyses possible gender bias in children's school outcomes.

Using IFLS panel data from 1997 to 2014 and applying child-level FE, the results illustrate that parental health shocks have a negative impact on school enrolment and attainment for both children and adolescents. Maternal and paternal health shocks affect school enrolment and attainment in both group of children; however, only paternal health shocks result in children joining the paid workforce.

Estimations on gender differentials, particularly in relation to school enrolment, show that parental health shocks are more likely to affect girls than boys; however, parental health shocks are also more likely to result in boys joining the paid workforce. Girls aged 6–14 attend fewer hours of school due to parental health shocks and girls aged 15–24 are less likely to be in school if their fathers experience health shocks; however, this group does not drop out of school to take up paid work. Boys are more likely to join the market workforce if their fathers experience health shocks, but girls are less likely to work for money if both mothers and fathers experience health shocks.

The findings from the third essay have important policy implications; they point to the need to build equal access to education for girls and boys (particularly secondary

education) and provide better access to health care and medical facilities to help parents to continue to invest in their children's human capital.

Appendix

Statement of contribution

Paper	Research Design	Data Analysis	Writing the Manuscript
Hasanah, A, Mendolia, S & Yerokhin, O 2017, 'Labour migration, food expenditure, and household food security in eastern Indonesia', *Economic Record*, vol. 93, pp. 122–143, doi:10.1111/1475-4932.12344.			
Alfiah Hasanah	30%	65%	70%
Silvia Mendolia	50%	20%	20%
Oleg Yerokhin	20%	15%	10%

Alfiah Hasanah Silvia Mendolia Oleg Yerokhin

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Labour Migration, Food Expenditure, and Household Food Security in Eastern Indonesia*

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This paper investigates the impact of migration on the food expenditure and household food security status of migrant-sending households using data from eastern Indonesia. We find that migration significantly increases food expenditure and overall household expenditure. Combining the food frequency and food consumption module of the Indonesia Family Life Survey (East), this paper shows that having at least one migrant in the family increases the composite index of Food Consumption Score, as well as the family's food security. Evaluation of food diversity also shows that migration increases expenditure on six out of ten food groups.

I Introduction

Migration has become one of the risk-reduction strategies used by households to overcome many poverty-related problems in developing countries. At the macro level, an investigation of economic outcomes of migration shows that remittances have a potential role in promoting economic growth and reducing the poverty of migrant-sending countries in the Asian region (Vargas-Silva *et al.*, 2009). Migration brings many benefits to the lives of migrants and their families (migrant-sending households (MSHs)), such as increased family income from remittances, decreased credit constraints, and investment in physical and human capital.

Poverty reduction is the welfare objective of many development programs. Many indicators are used to reflect multidimensional poverty, such as monetary poverty, food insecurity, malnutrition and other indicators of physical and economic well-being. Since the outcome of the migration is shared between migrants and MSHs (Stark & Bloom, 1985) there are studies on how migration can help MSHs to escape from poverty (Stark & Taylor, 1989; Adams, 1991; Adams & Page, 2005; Spatafora, 2005). However, there is very limited empirical evidence on the link between the poverty reduction effect of migration and food insecurity.

This paper attempts to fill this gap by extending the limited literature on migration in Indonesia in several ways. First, it investigates the impact of migration on food security using the Food Consumption Score (FCS), an indicator of household food security as suggested by the World Food Programme (WFP) and the Food and Agriculture Organization (FAO). The FCS is a proxy indicator of current household food security, and it includes information on food access and food utilisation (consumption). Another indicator of food security used by World Food Programme and Food and Agriculture Organization (2012) is Household Dietary Diversity Score (HDDS). At the household level, both the FCS and HDDS are

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